4-11-①

OU111 AR 569g

Geotech, Inc.

P.O. Box 14000
Grand Junction, Colorado 81502
303/248-6000

Shipping: 2597 B ¾ Road
Grand Junction, Colorado 81503

October 8, 1992

Mr. Eldon R. Bray
U.S. Department of Energy
Grand Junction Projects Office
P.O. Box 2567
Grand Junction, CO 81502

SUBJECT: TRANSMITTAL OF APPENDIX A REVISION - MONTICELLO MILL TAILINGS SITE OPERABLE UNIT III SURFACE- AND GROUND-WATER REMEDIAL INVESTIGATION/FEASIBILITY STUDY WORK PLAN

Dear Mr. Bray:

Enclosed is one copy of the revised subject document's Table of Contents and Appendix A for transmittal to Mr. Ron Kowalewski at DOE Headquarters. The revisions constitute changes to Table A1 through Table A3 of Appendix A; pages in these tables were inadvertently omitted during the report finalization copying process.

Please contact me at extension 6018 or Deb Richardson at extension 6065 if you have any questions or require additional information.

Sincerely,

Harry A. Perry
Program Manager

HAP/sn

Enclosures

OU III AR 569

MACTEC ENVIRONMENTAL RESTORATION SERVICES, LLC

4-11-2

JUN 19 1998

CONTRACT NO.: DE-AC13-96GJ87335
TASK ORDER NO.: MAC98-03
CONTROL NO.: 3100-T98-1256

June 19, 1998

Project Manager
Department of Energy
Grand Junction Office
2597 B¾ Road
Grand Junction, CO 81503
ATTN: Donald R. Metzler

SUBJECT: Contract No. DE-AC13-96GJ87335—Request for a Non-Time Critical Removal Action (Action Memorandum) for Operable Unit III in Monticello, Utah

Dear Mr. Metzler:

Enclosed is the Action Memorandum requesting a non-time critical removal action for OU III soil and sediment. Please have Mr. Tillman review and sign the signature sheet on Page 19 indicating his approval, then return the document to Kristen McClellen of my staff so that copies may be made for distribution.

Excavation is scheduled to begin June 23-24; it would be appreciated if the document could be signed by that time.

Should you have any questions, please call me at Extension 6332.

Sincerely,

Michael C. Butherus
Manager, Major Projects

KLM/djg
Enclosure
cc w/: K. L. McClellen, MACTEC-ERS
Project File: MSG2.0[PjM/MSG]

cc w/o: R. M. Plieness, DOE-GJO
Contract File (C. Spor)

C:\MONTICEL\KRISTEN\ACTIONMM.DOE

2597 B 3/4 ROAD
GRAND JUNCTION, COLORADO 81503
970/248-6000 (FAX) 970/248-6040

ACTION MEMORANDUM

Date: June 22, 1998

Subject: Request for a Non-Time Critical Removal Action at the Monticello Mill Tailings National Priorities List Site, Operable Unit III

From: Donald R. Metzler, Operable Unit III Project Manager

To: Jack B. Tillman, Manager Grand Junction Office

Information Copies To: Terry Anderson, Federal Facilities Program Director, EPA Region VIII
Brad T. Johnson, Manager, Utah Department of Environmental Quality

I. Purpose

The purpose of this Action Memorandum is to request and document approval of the proposed removal action described herein for the contaminated soil and sediment portion of Operable Unit III (OU III) at the Monticello Mill Tailings Site (MMTS). OU III of the MMTS is located near the city of Monticello in San Juan County, Utah. OU III covers contaminated surface water and groundwater at and downstream of the millsite and soils and sediments deposited downstream of the millsite adjacent to Montezuma Creek. This Action Memorandum applies to the soil and sediment portion of OU III only. The U.S. Department of Energy (DOE) is the lead agency responsible for remediation at the MMTS under the oversight authority of the U.S. Environmental Protection Agency (EPA) and the Utah Department of Environmental Quality (UDEQ).

II. Site Conditions and Background

The CERCLIS ID Number is UT3890090035 and the category of removal being requested is a non-time critical. This section provides an overview of the site history and current conditions.

A. Site Description

1. Removal Site Evaluation

The MMTS is a former uranium and vanadium processing mill that operated from the mid 1940's until 1960. Past processing operations at the mill produced several mill tailings piles that contain elevated concentrations of radionuclides and heavy metals. These mill tailings piles have been the primary source of contamination for OU III with releases occurring since the 1940's. As early as the 1950's, environmental investigations indicated

contaminant concentrations were being transported from the millsite via stream deposition to the area currently defined as OU III.

A preliminary assessment confirmed that elevated contaminant concentrations are located within OU III along the banks of Montezuma Creek in the floodplain and wetland areas. The key problem is soil and sediment contamination. Additional information on the history and contamination found at OU III is presented in the *Monticello Mill Tailings, Operable Unit III Remedial Investigation* report.

2. Physical Location

The millsite is a 110-acre tract of land owned by DOE that has approximately 200,000 cubic yards (cy) of contaminated material in the former mill area and an estimated 2.1 million cy of tailings and contaminated soil in the tailings impoundment area of the millsite. The tailings are contained in four piles within the floodplain of Montezuma Creek and serve as the primary source of soil and sediment contamination within OU III.

OU III of the MMTS includes contaminated groundwater, surface water, and soil and sediments downstream of the millsite in and adjacent to Montezuma Creek, a tributary to the San Juan River. This Action Memorandum pertains to the soil and sediment portion of OU III only. Future reference to OU III in this Action Memorandum pertains to only the contaminated soil and sediment area.

The portion of OU III addressed by this action begins approximately 0.5 mile east of the eastern millsite boundary and extends downstream approximately 14,000 feet (ft) (see Appendix A, Figures A–1 and A–2). OU III is located entirely on private land. On the basis of human-health risk scenarios developed for the baseline risk assessment during the remedial investigation and on ecological habitat changes along the creek, OU III was organized into three segments: Upper, Middle, and Lower Montezuma Creek segments. This Action Memorandum applies to all segments of Montezuma Creek.

Upper Montezuma Creek (see Appendix A, Figure A–1) is closest to the millsite and contains beaver ponds and areas where Montezuma Creek is entrenched. Upper Montezuma Creek begins approximately 0.5 mile below the millsite (western boundary of peripheral property, DOE number MP–00951) and extends to Easting (E) 31800 (coordinates based on the Monticello Project Coordinate System). Upper Montezuma Creek includes properties MG–00951, MG–01084, MP–00990–VL, MG–01033 and the western portion of MG–01026–VL. Properties MG–00951 and MG–01084 are owned by Brian and Sherill Bowring and properties MP–00990–VL, MG–01033, and MG–01026 are owned by Sutherland Brothers, Inc. Middle Montezuma Creek extends from E 31800 to E 34000. Middle Montezuma Creek includes a portion of property MG–01026 and property

MG–01027 owned by Sutherland Brothers, Inc. Lower Montezuma Creek begins at E 34000 and includes the area within the floodplain to a point approximately 3,000 feet below the confluence of Montezuma and Vega Creek. This property is owned by John and Charlotte Johnson. Upper, Middle, and Lower Montezuma Creek each contain soil-vegetation units corresponding to riparian and wetlands areas.

The Upper, Middle, and Lower Montezuma Creek segments are currently used for agriculture (grazing beef cattle) and occasional recreation (mostly deer hunting). No houses currently exist within OU III; however, there are two occupied residences located within ¼ mile of the OU III contaminated soil and sediment area (see Appendix A, Figure A–2). The Bowrings and Sheral Hollingsworth live approximately 1,000 ft and 1,600 ft, respectively, from OU III. Sheral Hollingsworth owns cattle that graze within OU III. Brian and Sherill Bowring have an elk ranch on their property. A toddler lives at the Bowring residence.

3. Site Characteristics

No structures or facilities exist within OU III. As stated earlier, the area is used for agricultural and recreational purposes, and the land is privately owned. If this Action Memorandum is approved, it would result in the first removal action within OU III.

4. Release or Threatened Release into the Environment of a Hazardous Substance, Pollutant, or Contaminant

The original source for all contaminants within OU III is the millsite and the tailings piles located on the millsite. Many of these same contaminants are found to exist in the native soils and sediments of the area. Table 1 lists hazardous substances, as defined by Section 101 (14) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), and pollutants or contaminants, as defined by Section 101 (33) of CERCLA, that are found above naturally occurring levels in soil and sediment and that may negatively impact human health or the environment.

Table 1. Known Hazardous Substances, Pollutants, or Contaminants Found in Soil and Sediment

Arsenic	Lead	Thorium-230	Uranium-238
Cobalt	Lead-210	Total Uranium	Vanadium
Copper	Radium-226	Uranium-234	Zinc
Molybdenum	Selenium	Uranium-235	External Gamma

The volume of material requiring removal varies depending on the cleanup level used to define the amount of remediation necessary within the Montezuma Creek segments. The *Monticello Mill Tailings Site, Operable Unit III, Alternatives Analysis* (Alternatives Analysis) (which is equivalent to the Engineering Evaluation/Cost Analysis [EE/CA]) evaluated 5 alternatives for Upper Montezuma Creek and 4 alternatives each for Middle and Lower Montezuma Creek using a cleanup level based on radium-226 (Ra-226) or microroentgens per hour (μR/hr) to define the extent of contamination. The Ra-226 contamination cleanup level is defined according to the standards in the Uranium Mill Tailings Remedial Action (Project) (UMTRA) (40 CFR 192): 5.0 picocuries per gram (pCi/g) within the top six inches and 15 pCi/g at depths greater than 6 inches. Table 2 presents a description of the alternatives for Upper, Middle, and Lower Montezuma Creek and the corresponding remediation volumes.

Organic contamination has not been identified at OU III; therefore, there are no substances of critical concern such as PCBs or dioxins. However, the contaminated materials at this site are unique because they contain a mixture of heavy metal and radioactive wastes.

The major release mechanism for the OU III contaminants is the transport from the surface water in Montezuma Creek and, to a lesser extent, wind erosion of the dryer material on the stream banks. Transport is accelerated during high water or windy conditions.

5. National Priorities List Status

The Monticello Mill Tailings Site, of which OU III is a part, was listed on the National Priorities List on November 16, 1989. No remediation has begun on OU III; however, remediation is being conducted or has been completed on the other properties near OU III. The millsite, designated Operable Unit I, is the primary source of contamination for OU III. The millsite is currently undergoing remediation and is expected to be completed in August 1999. Peripheral properties (designated Operable Unit II) which lie adjacent to OU III (MP–00951, MP–01084, MP–00990) have been remediated to the 5/15 pCi/g UMTRA Standard.

6. Maps, Pictures, and Other Graphic Representations

Figures are referenced throughout this memorandum, as appropriate; all figures are presented in Appendix A.

Table 2. Estimated Quantities of Contaminated Soil and Sediments[a]

Option[b]	Clean-Up Area Description	Clean-Up Area	Clean-Up Volume
Upper Montezuma Creek			
1	No Action	0 acres	0 yd^3
2	Institutional controls	0 acres	0 yd^3
3	Remediation to an Alternate Cleanup Level (35 µR/h gamma or 18 pCi/g Ra-226)	4.9 acres	14,300 yd^3
4a	Remediation to 5/15 pCi/g Ra-226 on MG–00951 and MG–01084	4.6 acres	8,300 yd^3
4b	Remediation to 5/15 pCi/g Ra-226 with No Action in the Pond Area	16.2 acres	34,700 yd^3
5	Remediation to 5/15 pCi/g Ra-226	20.1 acres	41,900 yd^3
Middle Montezuma Creek			
1	No Action	0 acres	0 yd^3
2	Institutional controls	0 acres	0 yd^3
3	Remediation to an Alternate Cleanup Level (35 µR/h gamma or 18 pCi/g Ra-226)	0.5 acres	1,400 yd^3
4	Remediation to 5/15 pCi/g Ra-226	2.5 acre	4,900 yd^3
Lower Montezuma Creek			
1	No Action	0 acres	0 yd^3
2	Institutional controls	0 acres	0 yd^3
3a	Remediation to an Alternate Cleanup Level (35 µR/h gamma or 18 pCi/g Ra-226)	1.5 acres	4,600 yd^3
3b	Remediation to an Alternate Cleanup Level (80 µR/h or 58 pCi/g Ra-226)	0.1 acre	500 yd^3
4	Remediation to 5/15 pCi/g Ra-226	5.0 acres	12,800 yd^3

[a]Source of all estimates is the Alternatives Analysis.
[b]As listed in the Alternatives Analysis

B. Other Actions to Date

1. Previous Actions

As mentioned above, remediation has not been initiated for OU III. However, several activities have been conducted to support future remediation decisions for OU III. Several discussions have been held with the community concerning OU III. The most important

discussion was with the landowners of each property within OU III. During this meeting, which was held on April 16, 1997, issues such as risk, remediation options, and the CERCLA process were discussed with the landowners. A second landowner briefing was held on September 18-19, 1997, with individuals that own property within OU III. Initial concurrence was received from the landowners on the approach to use hot-spot remediation.

Several of the properties near or adjacent to OU III have been remediated to the 5/15 pCi/g clean-up specified in the existing ROD for MMTS. Properties MP–00951, MP–01084, and MP–0090 have been remediated.

2. Current Actions

The millsite, which is the primary source of contamination for OU III, is currently being remediated to the 5/15 pCi/g clean up level. Clean up of the millsite started on June 5, 1997, and is expected to be complete August 1999. Tailings removed from the millsite are being placed in the nearby repository. The remediation activities on the millsite may impact OU III because additional sediment may be released via Montezuma Creek, which could further contaminate OU III. However, engineering controls and best management practices are being used to minimize any additional releases. These include on-site collection ditches that redirect water to holding ponds for treatment, silt fencing, and hay bail structures.

Property MP–00179, which is between the millsite and OU III, will be remediated to the 5/15 pCi/g clean up level. Clean up of the property is expected to be complete August 1999. Tailings removed from the property will be placed in the nearby repository. The remediation activities on the property may impact OU III because additional sediment may be released via Montezuma Creek, which could further contaminate OU III. However, engineering controls and best management practices are being used to minimize any additional releases. These include diversion of Montezuma Creek, use of silt fences, hay bails, and daily inspections and cleaning (if necessary) of the silt control measures. In addition, there will be two downstream silt control ponds.

C. State and Local Authorities Roles

1. State and Local Actions to Date

In 1989, DOE, EPA, and the State of Utah (State) entered into a Federal Facilities Agreement (FFA) for the MMTS (including OU III), pursuant to Section 120 of CERCLA. This agreement stipulated that EPA and the State share the responsibility for oversight of the MMTS. However, EPA has ultimate responsibility and authority for program oversight.

Oversight by the State is performed by UDEQ. Therefore, the State has been involved in the decisions concerning OU III.

As part of the CERCLA process, the local government and community have been involved and are cooperating with the State, EPA, and DOE on this project. Since the contaminants addressed in this Action Memorandum were not associated with an emergency spill or release, there were no "first responder" actions by State or local governments. Following the protocols established in the FFA, State/local cooperation is expected to continue in assessing the site and State/local personnel will periodically visit the MMTS and OU III, although these personnel will not remain permanently at the site.

2. Potential for continued State/local response

Pursuant to the processes established in the FFA, and in CERCLA, State and local personnel are expected to continue their involvement in OU III of the MMTS. No funding will be provided by the State or local government; all removal action funding will be provided by DOE. As stated earlier, the State has oversight authority for this project; however, the ultimate responsibility and authority for program oversight is with EPA.

III. Threats to Public Health or Welfare or the Environment, and Statutory and Regulatory Authorities

A CERCLA baseline risk assessment has been prepared for OU III (*Monticello Mill Tailings Site, Operable Unit III, Remedial Investigation*, Volume VI) and a Preliminary Public Health Assessment has been completed for the MMTS by the Agency for Toxic Substances and Disease Registry (*Preliminary Public Health Assessment for Monticello Mill Tailings* [DOE] Monticello, San Juan County, Utah CERCLIS No. UT 3890090035, September 30, 1997) that includes information for OU III. These documents can be found in the Administrative Record located at the Monticello City offices. They are the basis for the discussion concerning threats to public health or welfare and the environment.

A. Threats to Public Health or Welfare

Table 3 lists the contaminants of concern (COCs) to public health and welfare that have been identified in the soil and sediment within OU III. These COCs are not found at acute levels; however, they do have the potential to lead to long-term effects (mostly cancer) from prolonged exposures.

The potential receptors are future residents, agricultural workers, and recreational users.

The potential exposure routes are ingestion, inhalation, and direct radiation exposure; exposure occurs from incidental ingestion of soil and sediments and inhalation of dust. There are no known reports of human health effects (e.g. illness, injury or death) that appear to be linked to the exposure of contaminants found in the soil and sediments within OU III.

This Action Memorandum applies to soil and sediment contamination only. The contamination in soil and sediment has not impacted past uses (agricultural/recreational use) nor is it anticipated to have an impact in the future. This contamination has no impact on current drinking water supplies (nearby residents use municipal water from an uncontaminated, upstream source). Based on the unlikely assumption that the shallow alluvial aquifer could be used as a potential drinking water supply to future residents, the contamination in the soil and sediments of Upper Montezuma Creek could serve as a minor source of contamination for this aquifer.

Table 3. Contaminants of Concern

Contaminant	Area of Concern		
	Exceeds Background	Exceeds Health Benchmark	Process Knowledge
Arsenic	X	X[a]	X
Elemental Uranium	X		X
Pb-210	X		X
Ra-226	X	X[b]	X
Th-230	X		X
U-234	X		X
U-235	X		X
U-238	X		X
External Gamma	X	X[b]	X

[a]U.S. Environmental Protection Agency, 1996. Risk Based Concentration Table, January-June 1996, U.S. EPA Region III, Technical and Program Support Branch, September.
[b]40 CFR, Part 192.

There are no hazardous substances or pollutants or contaminants in drums, barrels, tanks or other bulk storage containers within OU III.

The contamination in the soil and sediments is located near the surface and has the potential to migrate. Montezuma Creek flows through OU III and has been the major transport mechanism for contamination to leave the millsite and be deposited in OU III. Montezuma Creek is also the major transport mechanism for contaminants to migrate from OU III. Releases are

accelerated during spring flooding or other high water events. To a lesser extent, releases from OU III occur from wind erosion of the dry soils. Releases via this transport mechanism would be accelerated during high wind events.

There are no threats of fire or explosion. No other situations or factors are known that may pose threats to public health or welfare.

B. Threats to the Environment

After evaluation of the results of dose modeling, histopathological analyses, tissue chemical analyses, and population surveys, the conclusion of the ecological risk assessment was, using a weight-of-evidence approach, all receptors chosen for evaluation appear to be at no significant risk from exposure to soil and sediment contamination.

IV. Endangerment Determination

Actual or threatened releases of hazardous substances, pollutants, and contaminants from this site, if not addressed by implementing the response action selected in this Action Memorandum, may present an imminent and substantial endangerment to public health, or welfare, or the environment.

V. Proposed Actions and Estimated Costs

A. Proposed Actions

1. Proposed Action Description

The proposed removal action for Upper Montezuma Creek is to excavate contaminated soil and sediment with surface gamma activity levels greater than 35 μR/h (equivalent to approximately 18 pCi/g Ra-226). The excavation area will be from the upper end of OU III (the western boundary of DOE property number MP–00951) downstream to E 30600 (located on DOE property number MG–01033), approximately 7,200 feet along Montezuma Creek. The proposed removal action includes dredging the pond just west of E 30600. Excavation within the areas that exceed 35 μR/h will continue at depth until the activity level of Ra-226 is less than 5 pCi/g above background in the top 6 inches or less than 15 pCi/g above background at depths greater than 6 inches. No excavation is proposed for the area of Upper Montezuma Creek east of E 30600.

In addition to the remediation to an alternative cleanup level, institutional controls will be placed on all land where contamination above the 5/15 pCi/g Ra-226 standard is left in place. The institutional control will be a "restrictive easement," which will place a restriction on the allowable uses of land within contaminated areas.

The proposed removal action is a combination of Alternative 2, Institutional Controls, and Alternative 3, Remediation to an Alternate Cleanup Level, as identified in the Alternatives Analysis.

The proposed action for Middle Montezuma Creek is to apply institutional controls in the form of a restrictive easement. The restrictive easement will be applied to all areas of Middle Montezuma Creek. The proposed action for Middle Montezuma Creek is Alternative 2, Institutional Controls.

The proposed removal action for Lower Montezuma Creek is to remediate soil and sediment from four areas that have surface gamma activities greater than 80 μR/h. Excavation within the four areas will continue at depth until the activity level of Ra-226 is less than 5 pCi/g above background in the top 6 inches or less than 15 pCi/g above background at depths greater than 6 inches. Remediation will discontinue when groundwater is encountered, even when the soil or sediments have Ra-226 activities exceeding 15 pCi/g.

In addition to the remediation to an alternative cleanup level, institutional controls will be placed on all land where contamination above the 5/15 pCi/g Ra-226 standard is left in place. The institutional control will be a "restrictive easement," which will place a restriction on the allowable uses of land within contaminated areas.

The proposed removal action for Lower Montezuma Creek is a combination of Alternative 2, Institutional Controls, and a modification of Alternative 3, Option B, remediation to an Alternate Cleanup Level. The proposed removal action differs from Alternative 3, Option B, in that only some of the areas identified with surface gamma activity levels greater than 80 μR/h will be remediated and excavation will not go below groundwater to remove soil and sediment with Ra-226 activities greater than 15 pCi/g.

The modifications to Alternative 3, Option B, were made to minimize the adverse effects of remediation while still removing some of the most contaminated material. All material excavated from Upper and Lower Montezuma Creek will be transported to the MMTS repository for disposal prior to its scheduled closure in August 1999.

Figures A–3 and A–4 show the areas to be excavated in Upper Montezuma Creek. Figure A–1 shows the properties that will be affected by the deed annotation in Middle Montezuma Creek. Figure A–5 shows the areas to be excavated in Lower Montezuma Creek. The removal action for Upper Montezuma Creeks excavates 16,000 yd^3 of soil and sediment over an area of 5.0 acres. The removal action for Lower Montezuma Creeks excavates approximately 90 yd^3 of soil and sediment over an area of 0.5 acre.

The removal action for Upper Montezuma Creek will reduce the reasonable maximum exposure health risk to 3.9×10^{-5} added cancer risk (from the baseline risk of 6.8×10^{-5} added cancer risks) and will reduce the central tendency health risk to 4.0×10^{-6} added cancer risk (from the baseline risk of 6.9×10^{-6} added cancer risks). Adverse effects to wetlands, water quality, and ecological receptors is significantly reduced from a remediation based on excavating all material with Ra-226 activities greater than 5/15 pCi/g above background. The deed annotation giving notice of the contamination left in-place provides greater assurance that someone will not build a residence in the contaminated areas.

The action for Middle Montezuma Creek does not reduce the health risk from the baseline condition of 4.7×10^{-6} added cancer risk for reasonable maximum exposure risk or 4.7×10^{-7} added cancer risk for the central tendency risk. However, it does provide greater assurance that someone will not build a residence in the contaminated areas.

The removal action for Lower Montezuma Creek does not significantly reduce the reasonable maximum exposure health risk from the baseline condition of 9.2×10^{-6} added cancer risk, or from the central tendency health risk for 6.0×10^{-7} added cancer risks, but does remove the most contaminated soil and sediment while minimizing adverse effects to wetlands, water quality, and ecological receptors.

These actions are being proposed because they are acceptable to the landowners, protect human health and the environment, comply with ARARs, minimize short-term adverse effects of remediation, are cost-effective, are consistent with the As Low As Reasonably Achievable (ALARA) goals for a radioactive site, and allow the excavated materials to be placed in the nearby MMTS repository before it is closed. The proposed actions are based on a risk management decision that considers and balances the issues listed above.

These actions comply with all ARARs. Compliance with 40 CFR 192 will be accomplished by applying supplemental standards. Application of supplemental standards is based on the criteria in 40 CFR 192.21(b); remediation to 5/15 pCi/g Ra-226 would cause environmental harm that is excessive compared to the health benefits of remediation to 5/15 pCi/g Ra-226.

Adverse short-term effects of remediation are minimized because remediation will only occur in limited areas of Upper and Lower Montezuma Creek. Remediation would not have significant adverse effects on ecological receptors. The net present cost of the proposed action for Upper Montezuma Creek is approximately 50 percent of the net present cost of remediating to 5/15 pCi/g Ra-226 in this area. The net present cost of the proposed action for Lower Montezuma Creek is approximately 15 percent of the net present cost of remediating to 5/15 pCi/g Ra-226 in this area.

This is a feasible technical solution (i.e., excavation of contaminated soil and sediment and disposal in a repository) and the reduction in the contaminated material within OU III will be effective in reducing the risk to public health and the environment or provide greater assurance that risks do not exceed the baseline condition.

The sampling data for this site has been obtained following procedures from the *Monticello Mill Tailings Site, Operable Unit III, Remedial Investigation/Feasibility Study Field Sampling Plan and Quality Assurance Project Plan* (March 1995), which has been reviewed by the Utah Department of Environmental Quality and EPA.

The sensitive habitat in Upper Montezuma Creek east of E 30600 and in Middle Montezuma Creek will not be affected because the removal action does not propose any remediation in these areas. The remediation in Lower Montezuma Creek has been designed to minimize impact to the sensitive habitat in this area. Restoration activities will reclaim all affected areas. No vulnerable sensitive populations have been identified in OU III. The location of contamination in the stream bed and floodplain may hamper removal activities, particularly during high water events. Equipment access to OU III should not be difficult in either Upper or Lower Montezuma Creek.

The location of OU III on private property may affect the implementation of the proposed action. No other factors exist that will affect implementation of this proposed action.

The contaminated material removed from OU III is being placed in an on-site repository. Therefore, off-site disposal is not needed and EPA's off-site policy is not applicable.

Post removal site control activities will not be required for this site. However, DOE is the lead federal agency for this site and will be conducting CERCLA 5-year reviews, which will require concurrence by EPA and UDEQ.

An alternative analysis for soil and sediment has been completed for this site, which is functionally equivalent to an EE/CA for non-time critical removals (see Appendix for a comparison of what is required in an EE/CA and what was provided in the Alternatives Analysis). This document underwent public comment from March 27 to April 27, 1998.

The remediation of Upper Montezuma Creek will require the diversion of Montezuma Creek around the area to be excavated. The diversion will be through 18-inch, smooth-lined, corrugated pipe and should not cause uncontaminated areas to become contaminated.

2. Contribution to Remedial Performance

Although a record of decision has not been signed for OU III, excavation of contaminated material is the selected remedy for the other Operable Units at the MMTS. If the proposed removal action completes the cleanup as proposed and the institutional controls are implemented, then no further action will be required for OU III. If additional areas require remediation following signing of the ROD, it is unlikely that a remedial action different than the other Operable Units would be selected for this site. Therefore, the proposed action is consistent with the likely long-term cleanup remedy for soils and sediments.

Although the proposed action focuses on soil and sediments, overall long-term remediation goals for OU III include surface water and groundwater. This action will have a minimal impact on groundwater, although it removes some materials that may act as a source to groundwater contamination.

3. Description of Alternative Technologies

No alternatives other than excavation of contaminated material and placement in a repository have been considered. Based on the remediation of the other operable units at this site and considerable experience remediating similar sites contaminated with uranium mill tailings, no other technology (e.g., soil washing) is cost-effective.

4. EE/CA

The Alternatives Analysis (Appendix B) is included with the Action Memorandum. Comments have been received on this document.

5. Applicable or Relevant and Appropriate Requirements (ARARs)

A list of potentially applicable or relevant and appropriate Federal and State requirements for OU III was presented in Section 3 of the Alternatives Analysis and the approach on meeting ARARs is presented in the Engineering Design Documents and are summarized below.

Federal ARARs:

- Uranium Mill Tailings Radiation Control Act
- Archaeological and Historical Preservation Act
- Fish and Wildlife Coordination Act
- Endangered Species Act
- Executive Order 11988 (floodplain management) and Executive Order 11990 (protection of wetlands)
- National Environmental Policy Act

State of Utah ARARs:

- Water Quality Rules
- Standards for Quality for Waters of the State
- Utah Pollutant Discharge Elimination System
- Groundwater Quality Protection
- Dredge or Fill Requirements
- Air Conservation Rules
- Hazardous Waste and Underground Storage Tank Management
- Corrective Action Cleanup Standards Policy for CERCLA and Underground Storage Tanks Sites
- Radiation Control
- Water Rights

6. Project Schedule

The schedule of major activities is shown below.

Activity	Completion Date
Engineering Design Complete for Lower Montezuma Creek	December 30, 1997
Engineering Design Complete for Upper Montezuma Creek	February 3, 1998
Concurrence by EPA and State on Engineering Designs	May 19, 1998
Begin Remediation of Upper Montezuma Creek	June 23, 1998 (target date)
Complete Restoration of Upper Montezuma Creek	September 30, 1999 (target date)
Begin Remediation of Lower Montezuma Creek	July 1998 (target date)
Complete Restoration of Lower Montezuma Creek	September 30, 1998 (target date)

The design documents contain schedules for individual properties.

B. Estimated Costs

The capital costs, annual costs, and total net present costs of the proposed removal action for Upper and Lower Montezuma Creek are listed below. CERCLA guidance was used to

estimate costs. Direct capital costs are the subcontract costs for construction. The estimate for direct capital costs assumes that excavated soil and sediment will be taken to the OU I repository with no cost for disposal, other than the cost of transportation to the repository. Indirect capital costs include design, construction oversight, and verification. Indirect capital costs were estimated at 70 percent of the subcontract cost of construction, based on historical costs for these elements. All capital costs are assumed to occur in year one.

Annual costs include the cost of DOE maintaining an LTSM office in Monticello and the annualized cost of a CERCLA 5-year review. Ten percent of the total cost of the LTSM office was allocated to the removal action for Upper Montezuma Creek and to the removal action for Lower Montezuma Creek. Calculation of the net present cost of annual costs is based on OMB guidance (OMB 92) that recommends using unescalated annual costs, a real discount rate of 7 percent, and a maximum discount period of 30 years.

Upper Montezuma Creek

Capital Costs:	
Direct Capital Costs	$ 700,000
Indirect Capital Costs	$ 490,000
Total Capital Costs	$1,190,000
Annual Costs:	
LTSM Office	$ 10,000
CERCLA 5-Year Review (annualized)	$ 2,300
Total Annual Costs	$ 12,300
Net Present Cost of Annual Costs:	
Net Present Cost = Annual Costs x Present Worth Factor (30 years, 7 percent)	
Net Present Cost = $12,300 x 12.409 =	$ 153,000
Upper Montezuma Creek Total Net Present Cost	
Total Net Present Cost = Total Capital Costs + Net Present Cost of Annual Costs	
Total Net Present Cost = $1,190,000 + $153,000 =	$1,343,000

Middle Montezuma Creek:

Capital Costs:	
Direct Capital Costs	$ 8,000
Indirect Capital Costs	$ 6,000
Total Capital Costs	$ 14,000

Annual Costs:

LTSM Office	$ 10,000
CERCLA 5-Year Review (annualized)	$ 2,300
Total Annual Costs	$ 12,300

Net Present Cost of Annual Costs:

Net Present Cost = Annual Costs x Present Worth Factor (30 years, 7 percent)

Net Present Cost = $12,300 x 12.409 = $153,000

Middle Montezuma Creek Total Net Present Cost

Total Net Present Cost = Total Capital Costs + Net Present Cost of Annual Costs

Total Net Present Cost = $14,000 + $153,000 = $167,000

Lower Montezuma Creek

Capital Costs:

Direct Capital Costs	$ 41,000
Indirect Capital Costs	$ 29,000
Total Capital Costs	$ 70,000

Annual Costs:

LTSM Office	$ 10,000
CERCLA 5-Year Review (annualized)	$ 2,300
Total Annual Costs	$ 12,300

Net Present Cost of Annual Costs:

Net Present Cost = Annual Costs x Present Worth Factor (30 years, 7 percent)

Net Present Cost = $12,300 x 12.409 = $ 153,000

Lower Montezuma Creek Total Net Present Cost

Total Net Present Cost = Total Capital Costs + Net Present Cost of Annual Costs

Total Net Present Cost = $70,000 + $153,000 = $ 223,000

VI. Expected Change in the Situation Should Action be Delayed or Not Taken

Delayed action will increase the probability that nearby populations will be exposed to the contaminants in Upper, Middle, and Lower Montezuma Creek and that this contamination may be transported downstream. The proposed action will decrease potential exposures to recreational users, agricultural workers, livestock, and wildlife. An added advantage of this proposed action is

that these materials can be placed in the on-site repository, which is scheduled to be closed August 1999.

VII. Outstanding Policy Issues

None.

VIII. Enforcement

This removal action is being undertaken by the Principal Responsible Party (PRP [DOE]) as stipulated in the FFA and is not part of an enforcement being undertaken by EPA.

IX. Recommendation

This decision document represents the selected removal action for OU III of the Monticello Mill Tailings Site located near Monticello, Utah, developed in accordance with CERCLA as amended, and not inconsistent with the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the administrative record for the site. It is recommended that the options involving hot spot remediation of soil and sediment in Upper and Lower Montezuma Creek and restrictive easements in all segments of the creek be implemented in order to limit potential migration of contaminants, mitigate exposures to nearby populations, avoid environmental damage that would be caused by full-scale remediation, meet the wishes of the landowners, and enable the removed material to be placed in the on-site repository before it closes.

This page intentionally blank

Approval

The U.S. Department of Energy makes the determination that it will proceed with the non-time critical removal action of Upper and Lower Montezuma Creek.

Approved by: _____

Jack Tillman, Manager
Grand Junction Office
U.S. Department of Energy

Distribution of Complimentary Copies:

Paul Mushovic, EPA Region VIII
Jay Silvernale, EPA Region VIII
David Bird, Utah Department of Environmental Quality
Brent Everett, Utah Department of Environmental Quality
William Sinclair, Utah Division of Radiation Control

This page intentionally blank

Appendix A

Maps, Pictures, and Other Graphic Representations

This page intentionally blank

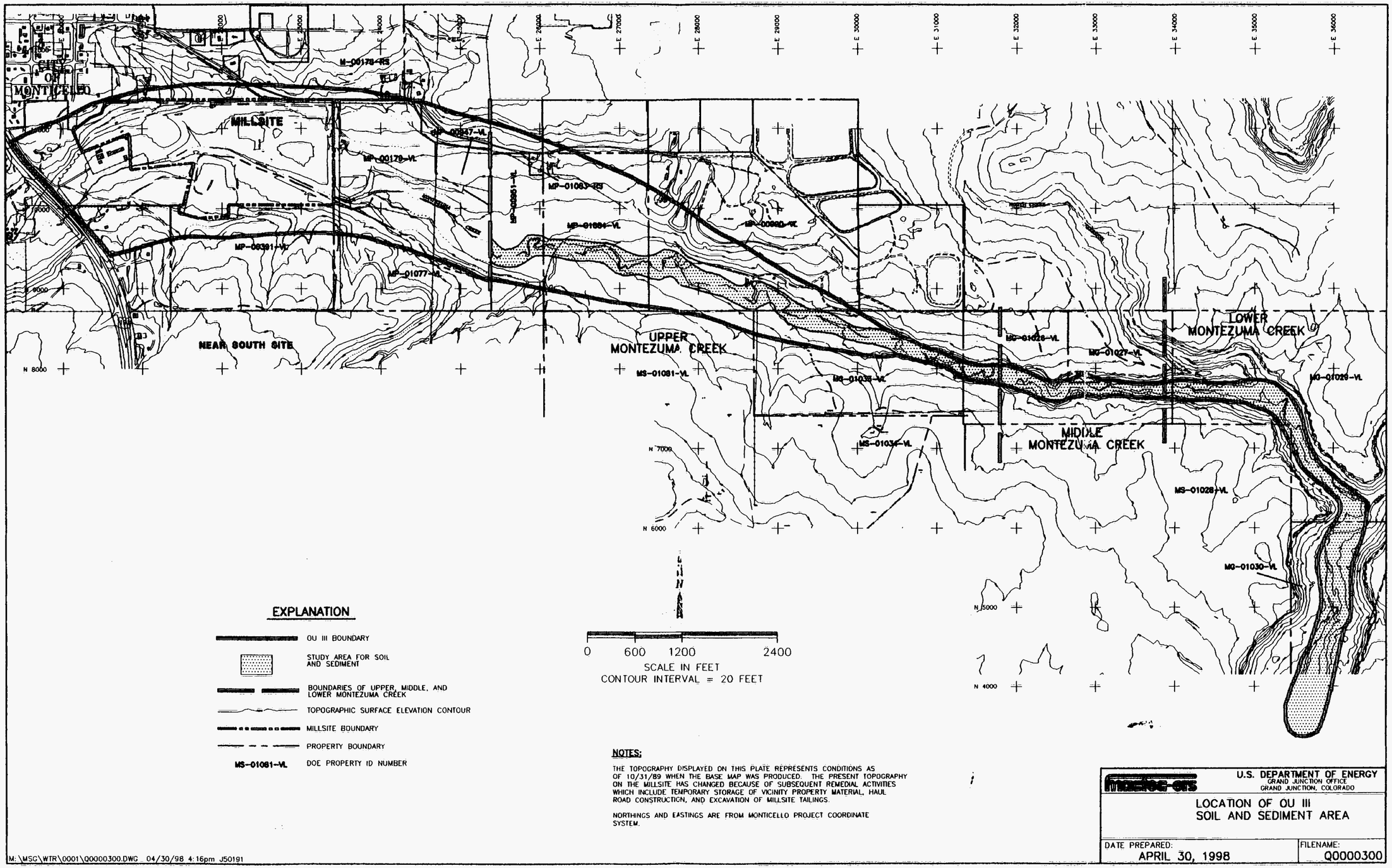


Figure A-1. OU III Contaminated Soil and Sediment Area

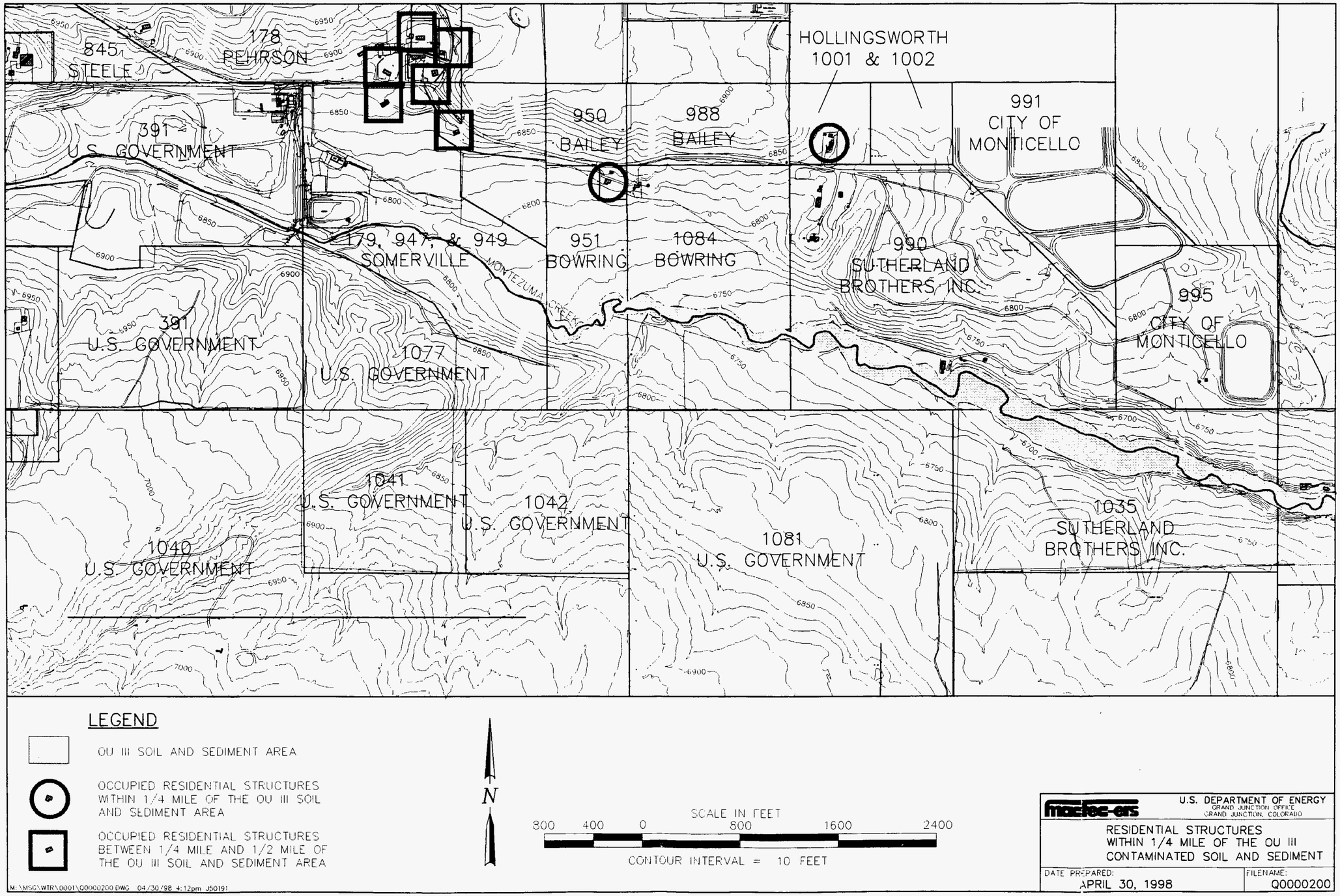


Figure A-2. Location of Nearby Residences and the Property Boundaries

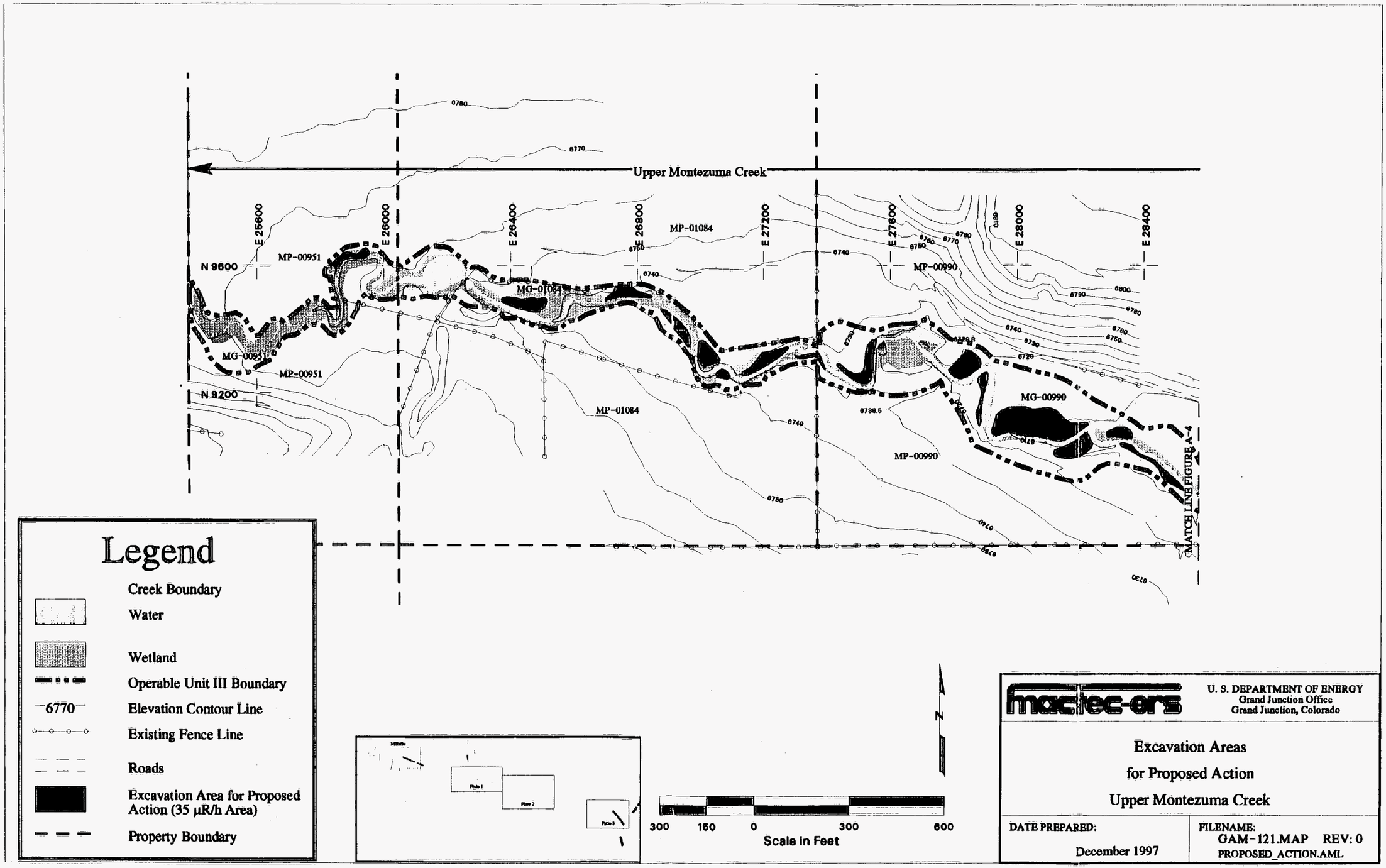


Figure A-3. Excavation Areas for the Proposed Action—Upper Montezuma Creek, Part A

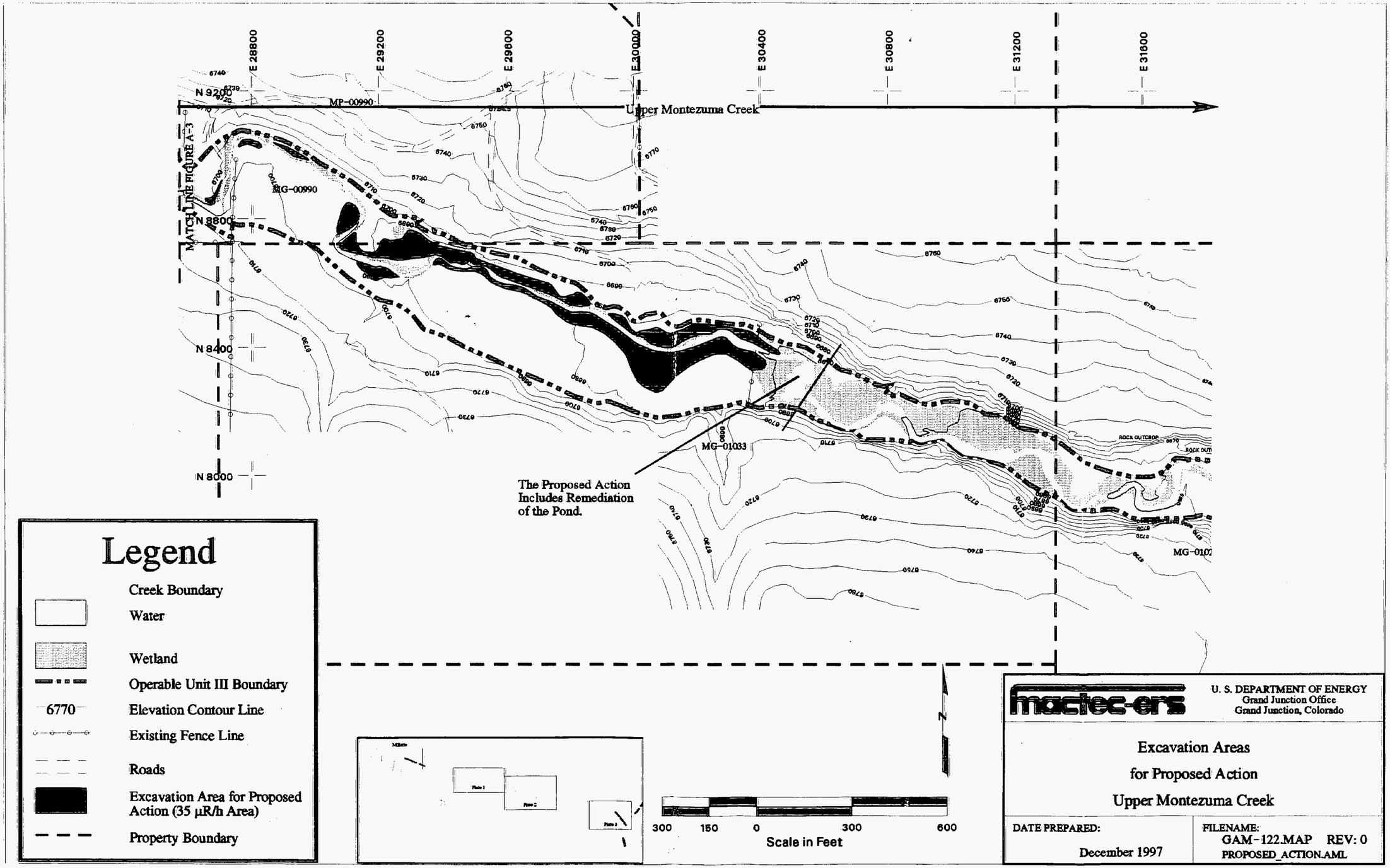


Figure A–4. Excavation Areas for the Proposed Action—Upper Montezuma Creek, Part B

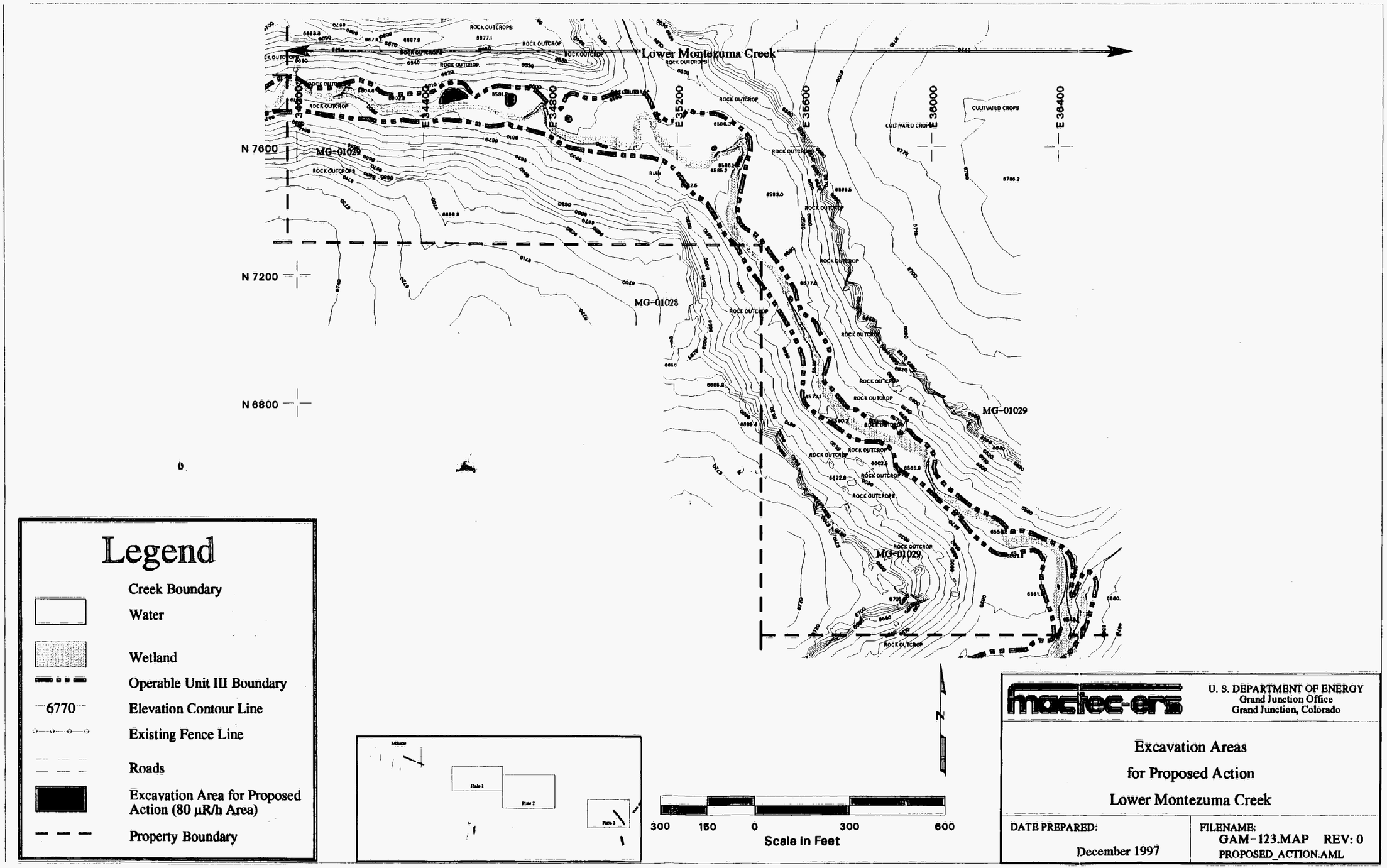


Figure A-5. Excavation Areas for the Proposed Action—Lower Montezuma Creek

Appendix B

Alternatives Analysis

[to be provided with final document]

This page intentionally blank

Appendix C

Comparison of an EE/CA to the Alternatives Analysis

This page intentionally blank

Components of an EE/CA	Components of the Alternatives Analysis for OU III
Executive Summary	Executive Summary
Site Characterization	Section 2.0 Summary of the Remedial Investigation Section 3.0 Applicable or Relevant and Appropriate Requirements
Identification of Removal Action Objectives	Section 4.0 Remedial Action Objectives and Preliminary Remediation Goals
Identification and Analysis of Removal Action Alternatives	Section 5.0 Remedial Technology Types Section 6.1- 6.4 Upper Montezuma Creek Section 7.1- 7.4 Middle Montezuma Creek Section 8.1- 8.4 Lower Montezuma Creek
Comparative Analysis of Alternatives	Section 6.5 Upper Montezuma Creek Section 7.5 Middle Montezuma Creek Section 8.5 Lower Montezuma Creek
Recommended Removal Action Alternative	Section 9.0 Recommended Removal Actions

This page intentionally blank

Appendix D

Public Involvement

This page intentionally blank

Overview

This appendix provides an overview of the public involvement activities concerning the proposed removal action for Operable Unit (OU) III soil and sediment at the Monticello Mill Tailings Site.

The public was informed of the selected removal action in the following ways:

- All items contained within the Administrative Records have been on file at the subject repositories since the final, or in some cases draft final, version of each document was issued.
- Copies of the *Alternative Analysis of Soil and Sediment* and the *Action Memorandum* were made available in the public reading room and at the public meeting.
- Informal discussions were held with the private property owners that would be impacted by this removal action.
- The Site-Specific Advisory Board was briefed on the proposed removal action.
- A public comment period was held from March 27, 1998, to April 27, 1998.
- A full page notice of the public comment period and public meeting was published in the local weekly newspaper before the public meeting.
- Notices of the public comment period and public meeting were prominently posted at several of the most frequented businesses in the Monticello area.
- A public service announcement was aired by a local radio station to notify listeners about the time and location of the public meeting.
- A public meeting was held on April 7, 1998, at the Monticello High School auditorium.
- Written comments by the public were encouraged.

The public meeting on April 7, 1998, was sparsely attended. The few questions and comments that were received are summarized, along with responses, are summarized below. The selected remedy presented in the *Alternatives Analysis of Soil and Sediment* and this *Action Memorandum* was not modified based on any comments received. The public meeting also included a discussion of proposed cleanup of groundwater associated with OU III through an interim remedial action. Comments received on the interim remedial action are included in the Responsiveness Summary in the *Interim Record of Decision.*

Comments Received at the Public Meeting and Agency Responses

One community member asked if there is a possibility that the repository will close before things are cleaned up. The response was the repository will remain open until this cleanup is complete.

One community member asked if the areas of contamination have been identified. The response was that they have been identified and they were shown on the map displayed at the public meeting. In addition, this information is available in the reading room.

One community member asked if the material (soil and sediment) in the Upper and Lower Montezuma Creek areas will be backfilled after excavation. The response was that areas excavated in the Upper Montezuma Creek will be backfilled and areas in Lower Montezuma Creek will not.

OU III AR 569 g

mactec-ers
MACTEC ENVIRONMENTAL RESTORATION SERVICES, LLC

4-11 (3)

CONTRACT NO.: DE-AC13-96GJ87335
TASK ORDER NO.: MAC01-01
CONTROL NO.: 3100-T01-0479

March 29, 2001

Project Manager
Department of Energy
Grand Junction Office
2597 B3/4 Road
Grand Junction, CO 81503
ATTN: Mr. Joel D. Berwick

SUBJECT: Contract No. DE-AC13-96GJ87335—Monticello Operable Unit III
Nitrate and Selenium White Paper

Dear Mr. Berwick:

Attached is a revised copy of the subject document that incorporates your comments. Two additional copies are enclosed for transmittal to EPA and UDEQ.

Should you have any questions, please do not hesitate to contact me at Extension 6332.

Sincerely,

Carl J Jacobson for MCB

Michael C. Butherus
Manager, Major Projects

KLM/djg
Attachment
cc w/: Project Record File MSG 2.2.5 thru Jalane Glasgow
Administrative Record (2 copies) thru Tom Kirkpatrick

cc w/o: K. McClellen
Contract File (J. Dearborn)

2597 B 3/4 ROAD
GRAND JUNCTION, COLORADO 815
(PHONE) 970/248-6000 (FAX) 970/248

3/29/01

Discussion of Nitrate and Selenium Increases in Groundwater at Monticello, UT

Nitrate levels in groundwater began to increase in January 1999 on MP-00179 although the trend was not readily apparent until the April 1999 sampling data were received. DOE discussed with EPA and UDEQ possible reasons for the recent increase in nitrate levels in groundwater and has investigated the following possible explanations: (1) groundwater nitrate increases may have been caused by use of irrigation water from the sewage treatment plant, (2) backfill borrow sources on Sommerville's property may have contained high levels of nitrate, (3) fertilization practices on the millsite and MP-00179 may have caused increases in groundwater nitrate and/or (4) the south source area seep water may be infiltrating to groundwater.

1. Use of irrigation water from the sewage treatment plant:
Irrigation water from the sewage treat plant is not the source of the increased nitrate concentrations in groundwater. Sewage plant effluent is used only to irrigate south of Montezuma Creek. Prior to remediation and creek realignment during Phase III and IV, well 88-85, which exhibits increased nitrate levels, was north of the creek (see Figure 1 showing affected wells). Groundwater would not flow from south of the creek in the direction of wells 92-11 and 88-85. Fields north of the creek are irrigated with water from Loyd's Lake.

2. Backfill borrow sources on MP-00179, Phase III and Phase IV (Sommerville's property): The source for topsoil and subsoil backfill on Sommerville's property was the Jenson Pit, located 2 miles south of Monticello, also known as "Crowley's topsoil borrow area." Test results of soil samples (7 samples) collected from the borrow area in 1998 and 1999 indicated that nitrate-nitrogen concentrations ranged from 1.8 to 12.6 mg/kg, all of which are typical for native soils in Monticello. A "quality control" composite soil sample collected from the Phase III property immediately after backfill placement and before fertilizer was added indicated a nitrate-nitrogen concentration of 5.1 mg/kg. These borrow site and backfill concentrations are considered "normal" and are not excessive. For example, Colorado State University Extension (Follett et al. 1991) considers a soil nitrate-nitrogen concentration of 40 mg/kg as optimal for irrigated pasture and a concentration of 20 mg/kg as optimal for dryland pasture.

The borrow source and in-place soil nitrate-nitrogen concentrations were compared to nitrate-nitrogen concentrations in Sommerville's soils before remedial action was initiated. No noticeable differences were found. Nitrate-nitrogen concentrations in pre-remedial soil samples (25 samples), collected in 1992, ranged from 1.0 to 9.0 mg/kg, with the exception of two samples in bottomland boggy areas (19.0 and 23.0 mg/kg) and two samples in cattle-concentration areas (97.0 and 130.0 mg/kg).

As a result of this analysis, DOE concludes that the backfill borrow source is not responsible for the recent increases in groundwater nitrate concentrations. Copies of soil test results are in Appendix A.

3. Fertilization practices on the millsite and MP-00179, Phases III and IV (Sommerville property): OHM's revegetation subcontractor, WD Yards, first began applying chemical fertilizer to barren areas on the millsite in April 1998. A pelletized ammonium sulfate fertilizer was hydraulically applied at a rate of 54 lb/acre over 65 acres. At the same time, 135 lb/acre of phosphorus (P_2O_5) was applied. During later seedings in fall 1998, spring 1999, and January and spring 2000, nitrogen, phosphorus and potassium fertilizer was applied at a rate of 30 lb/acre for each constituent. [Note: The ammonium (NH_4^+) in an ammonium sulfate fertilizer converts to nitrate in a matter of weeks in the soil.]

On Phase III and Phase IV of Sommerville's property (see Figure 1), nitrogen, phosphorus, and potassium were applied to freshly backfilled topsoil in early March 1999 (east end of Phase III), November 1999 (Phase IV), and April 2000 (west end of Phase III). Application rates were approximately 50 lbs/acre nitrate, 30 lbs/acre phosphorus (P_2O_5), and 50 lbs/acre potassium (K_2O) in each case.

In all these cases, the potential for nitrate leaching through soil into shallow groundwater was high. If no plants or microbes exist in the soil to use nitrate, it is easily leached, as this anion is not retained by the soil's cation exchange capacity (Bohn *et al.* 1979). Nitrate leaching is most pronounced in late fall, winter, and early spring when plants that may use nitrogen are young, seasonally inactive, or have not yet germinated, the latter of which was the primary situation on the millsite and Sommerville property. In addition to the lack of plants, the lack of microbes in the sterile subsoils exposed on the millsite likely contributed to the potential for nitrate leaching on the millsite.

The increase in groundwater nitrate concentrations, beginning January 1999 (see Figure 2), in wells immediately downgradient of the millsite (well 92-11) and MP-00179 Phase IV (wells 88-85 and 92-07) coincides with the fall 1998 fertilizer application on the millsite. Groundwater nitrate concentrations in these wells peaked in April 2000 and then decreased in wells 88-85 and 92-07 in July and October 2000. At well 92-11, nitrate concentrations have fluctuated, however, preliminary results from January 2001 (13,900 µg/L) are the lowest measured at that well in nearly two years. The decrease in groundwater nitrate concentrations seems to coincide with the conclusion of fertilizer applications on the millsite and Phase IV of Sommerville's property.

Further downgradient in MP-00179 Phase III, nitrate concentrations in wells 82-07, 82-08, and 92-08 did not "jump" until about July 1999. The amplitude of this jump was much less than that associated with the three wells immediately downgradient of the millsite and Phase IV, but it is a noticeable increase compared to the previous 5 years of data. This increase coincides with the beginning of fertilizer applications on the east end of Phase III. Groundwater nitrate concentrations continued to increase in the three wells through the November 1999 and April 2000 fertilizer applications on Phase IV and the west end of Phase III. One reason the increase might have been smaller than that seen in the three upgradient wells is that the soils backfilled on

Phase III and Phase IV were relatively rich in organic matter and contained considerably more microbes than the sterile millsite soils. Additionally, the acreage that was fertilized, and hence the total amount of fertilizer applied, was significantly smaller on Phases III and IV than on the millsite. The acreage of Phases III and IV combined is approximately 1/5 that of the millsite.

Beginning in April 1998, sulfate concentrations increased in several wells on property MP-00179 (Figure 3). The increase is sulfate seems to roughly coincide with the increase in nitrate concentrations and may be due to the dissolution of the ammonium sulfate fertilizer.

Given the coincidental timing of fertilizer applications and groundwater nitrate (and sulfate) increases, DOE believes that the leaching of chemical fertilizer may be, at least in part, the cause of the nitrate increases. The case for this belief would be strengthened if nitrate concentrations in the affected wells decrease in the next year or so.

4. **South Source Area**: Samples from Seep 4307 had nitrate as nitrogen concentrations of 80.0 mg/L and 0.49 mg/L; samples from Seep 5215 had nitrate as nitrogen concentrations of 81.9 mg/L and 54.1 mg/L. These results are comparable to historical results from well 31SW91-35 that was on the Acid Pile (263 mg/L) and well 31SW91-23 that was on the northeast toe of the Acid Pile (36 to 43 mg/L). Well 31SW91-35 was generally dry and was only sampled once. It is possible that water from the seeps has infiltrated and contributed to contamination of the alluvial aquifer.

DOE investigated possible reasons for the increase in groundwater selenium concentrations in wells 82-07, 88-85, 92-07, and 92-11 (Figure 1): (1) selenium may have been in a backfill source, (2) selenium may have been in elk feed, (3) selenium may have been in irrigation water from the sewage treatment plant, and/or (4) selenium may have been leached from newly exposed bedrock sources on the millsite.

1. Selenium may have been in a backfill source: Although selenium analysis has not been conducted on soils from the Jensen Pit or other borrow sources in the Monticello area, it is unlikely that the backfilled soils on MP-00179 are responsible for the recent increases in groundwater selenium. The loess-derived soils used for topsoil backfill in Monticello are unlikely to contain significant amounts of selenium, as they are not marine-deposited. Seiler *et al.* (1999) state that: "In the Western United States, areas are unlikely to be contaminated by selenium if they do not contain and have no nearby Upper Cretaceous or Tertiary marine sedimentary deposits." In addition, plants such as locoweed (*Astragalus* sp.), copperweed (*Oxytenia* acerosa), crazyweed (*Oxytropis* sp.), prince's plume (*Stanleya pinnata*), and certain species of *Brassica* that are known to grow on selenium-laden soils (Banuelos *et al.* 1997; Andrews 2001; Taylor 1992) do not occur on the soil borrow areas in Monticello.

2. Selenium may have been in elk feed: This scenario is unlikely as well, mainly because the wells affected by selenium increases are upgradient of Bowring's elk operation. Additionally, the selenium in animal feed is commonly in the form of selenite, which typically adsorbs to soil clays and hydrous oxides rather than remaining in the soil solution (Oldfield 1992).

3. Selenium may have been in irrigation water from the sewage treatment plant: Treatment plant effluent is not likely the source of increased selenium levels for the same reasons it is not the nitrate source, as described above.

4. Selenium may have been leached from newly exposed bedrock sources on the millsite: This scenario is more likely than the previous scenarios to be the cause of selenium increases in groundwater. Mancos Shale and the coaly, carbonaceous part of the Dakota Sandstone, both of which outcrop on the millsite, are known to contain elevated concentrations of selenium (DOE 1998, USGS 1995, Seiler *et al.* 1999). Both of these formations were uncovered and left exposed on the millsite during remediation. DOE hypothesizes that exposure to air and water allowed selenium-containing sulfide materials in unweathered portions of the formations to be oxidized, hence allowing selenium to be released into solution. A considerable portion of exposed, unweathered bedrock was thoroughly washed, from early September 1998 to late October 1998, to remove contamination. Since middle 1998 and up to late 2000, large areas of newly exposed Dakota Sandstone and Mancos Shale were covered with numerous ponds (the East Pond being the largest) and subject to leaching by pond water, precipitation, runoff, and Montezuma Creek flows. The increase in selenium concentrations in alluvial wells downgradient of the millsite began in April 1999 (Figure 4), approximately 6 months after large areas of Dakota Sandstone and Mancos Shale were first exposed on the millsite. As shown on Figure 4, the largest increase in selenium concentration has occurred at well 92-11. Elevation of the top of bedrock was checked for the wells along the eastern boundary of the millsite to determine if a bedrock low exists upgradient of well 92-11 that might account for the distribution of selenium (Figure 5). Given the spacing of wells (approximately every 50 ft), there does not appear to be a bedrock trough upgradient of well 92-11.

Mancos Shale was also exposed on the millsite during construction of the site access/staging area in 1992. Work started on July 29, 1992 in the northwest corner of the millsite. Remediation of the tailings in this area exposed Mancos Shale bedrock; seeps were evident along the north where the slope was cut. By September 1992, verification of the access area was nearly complete. As shown on Figure 4, there is a temporary increase of selenium concentrations in downgradient groundwater in April 1993. Whether this increase can be attributed to the exposed Mancos during construction of the site access area is unknown.

Selenium concentrations have also increased in surface water at locations SW00-03, Sorenson, and SW00-04 that is at the outlet of the beaver pond (Figure 6). Concentrations tripled from about 3 µg/L to 8 µg/L between the January and April

2000 sampling rounds, approximately one year after the selenium increase in groundwater was first observed. The increase in selenium is surface water is attributed to discharge of groundwater with increased levels of selenium.

Conclusion

DOE believes that the increased nitrate concentrations in the groundwater are most likely the result of leaching of chemical fertilizer that was applied to the millsite and Property MP-00179. Because fertilization was a short duration event during seeding, it is expected that nitrate levels will decrease through natural flushing. Therefore, it is recommended that only monitoring of the nitrate concentration be done at this time.

DOE believes that the increased selenium levels in the groundwater are most likely the result of leaching from recently exposed, unweathered bedrock. Therefore, it is recommended that no further investigation into the selenium source be conducted at this time. Selenium levels will be monitored as part of the groundwater sampling program.

Literature Cited:

Andrews, Don, 2001. Personal Communication between Marilyn Kastens, MACTEC-ERS, Grand Junction, CO, with Don Andrews, Soil Conservationist, Natural Resources Conservation Service, Monticello, UT, February 26, 2001.

Banuelos, G.S., H.A. Ajwa, N. Terry, and A. Zayed, 1997. "Phytoremediation of selenium laden soils: a new technology" in *Journal of Soil and Water Conservation* 52(6) 426-430.

Bohn, H., B. McNeal, and G. O'Connor, 1979. *Soil Chemistry*. John Wiley & Sons, New York.

Follett, R.H., P.N. Soltanpour, D.G. Westfall, and J.R. Self, 1991. *Guide to Fertilizer Recommendations in Colorado.* Department of Agronomy, Colorado State University, Fort Collins, CO.

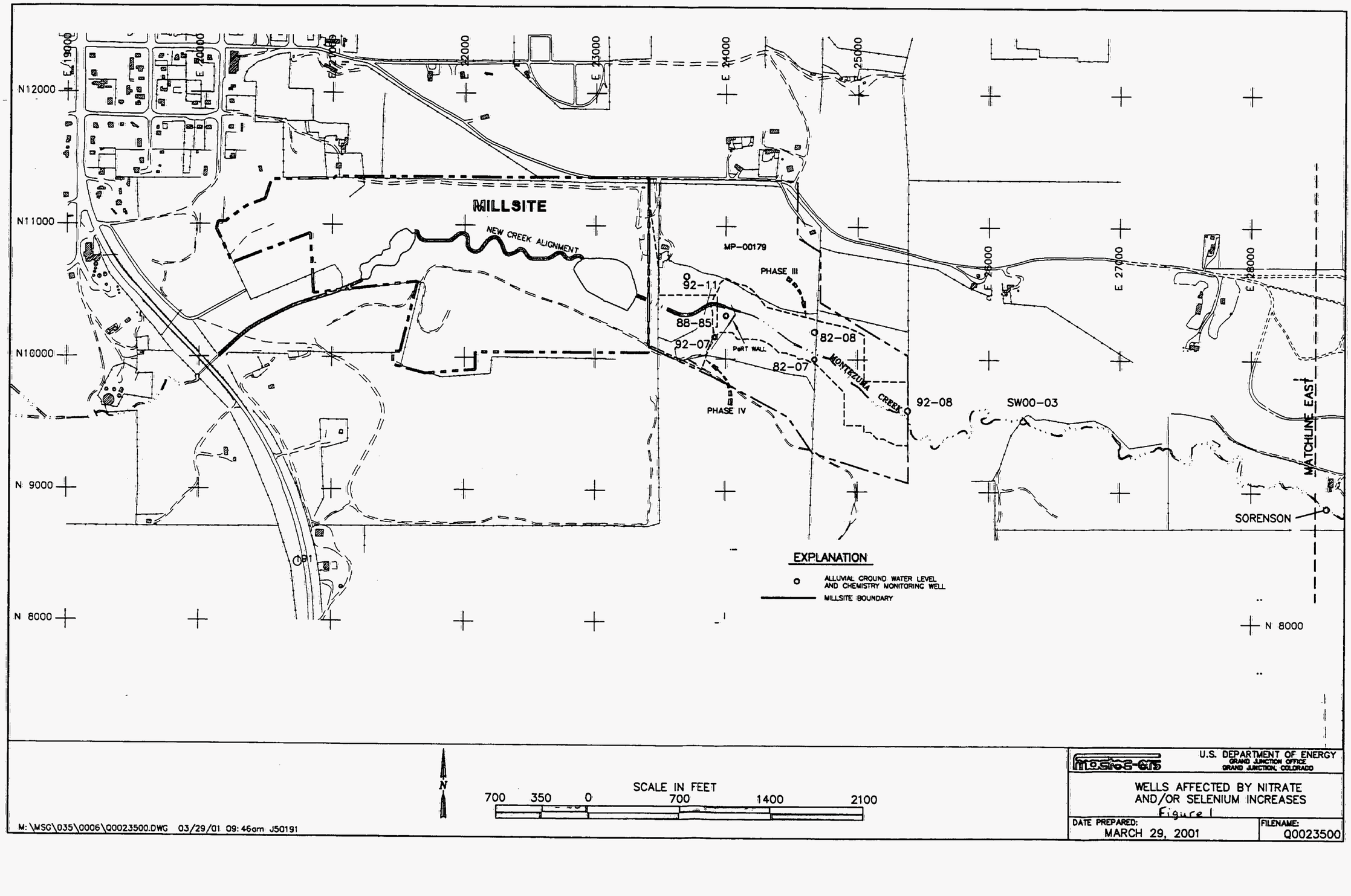
Oldfield, J.E., 1992. "Risks and benefits in agricultural uses of selenium" in Environmental Geochemistry and Health, 1992, Vol. 14, pages 81-86.

Seiler, R.L., J.P. Skorupa, and L.A. Peltz, 1999. *Areas Susceptible to Irrigation-Induced Selenium Contamination of Water and Biota in the Western United States*, U.S. Geological Circular 1180, U.S. Geological Survey, Denver, CO.

Taylor, Ronald J., 1992. *Sagebrush Country, A Wildflower Sanctuary*. Mountain Press Publishing Company, Missoula, MT.

U.S. Department of Energy, 1998. *Monticello Mill Tailings Site Operable Unit III Remedial Investigation*, Volume 1, U.S. Department of Energy Grand Junction Office, Grand Junction, CO, September.

U.S. Geological Survey, 1995. *U.S. Geological Survey Fact Sheet: Monitoring environmental effects of irrigation projects in the West*, U.S. Geological Survey, Denver, CO, August.



M:\MSG\035\0006\Q0023500.DWG 03/29/01 09:46am J50191

MOSES-GIS

U.S. DEPARTMENT OF ENERGY
GRAND JUNCTION OFFICE
GRAND JUNCTION, COLORADO

WELLS AFFECTED BY NITRATE AND/OR SELENIUM INCREASES
Figure 1

DATE PREPARED: MARCH 29, 2001

FILENAME: Q0023500

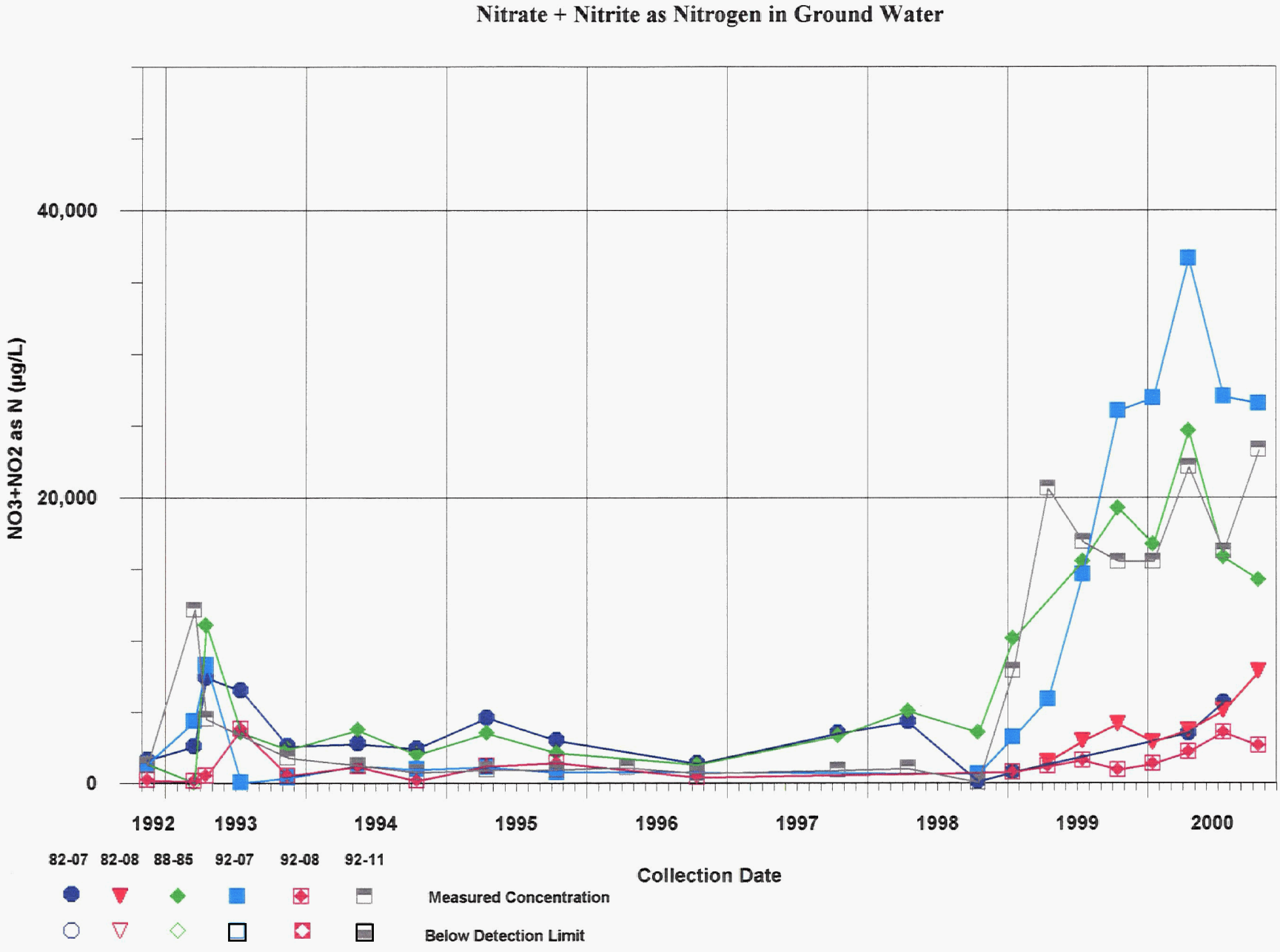

Nitrate + Nitrite as Nitrogen in Ground Water
NO3+NO2 as N (µg/L)
40,000
20,000
0
1992
1993
1994
1995
1996
1997
1998
1999
2000
Collection Date
82-07
82-08
88-85
92-07
92-08
92-11
Measured Concentration
Below Detection Limit

Figure 2

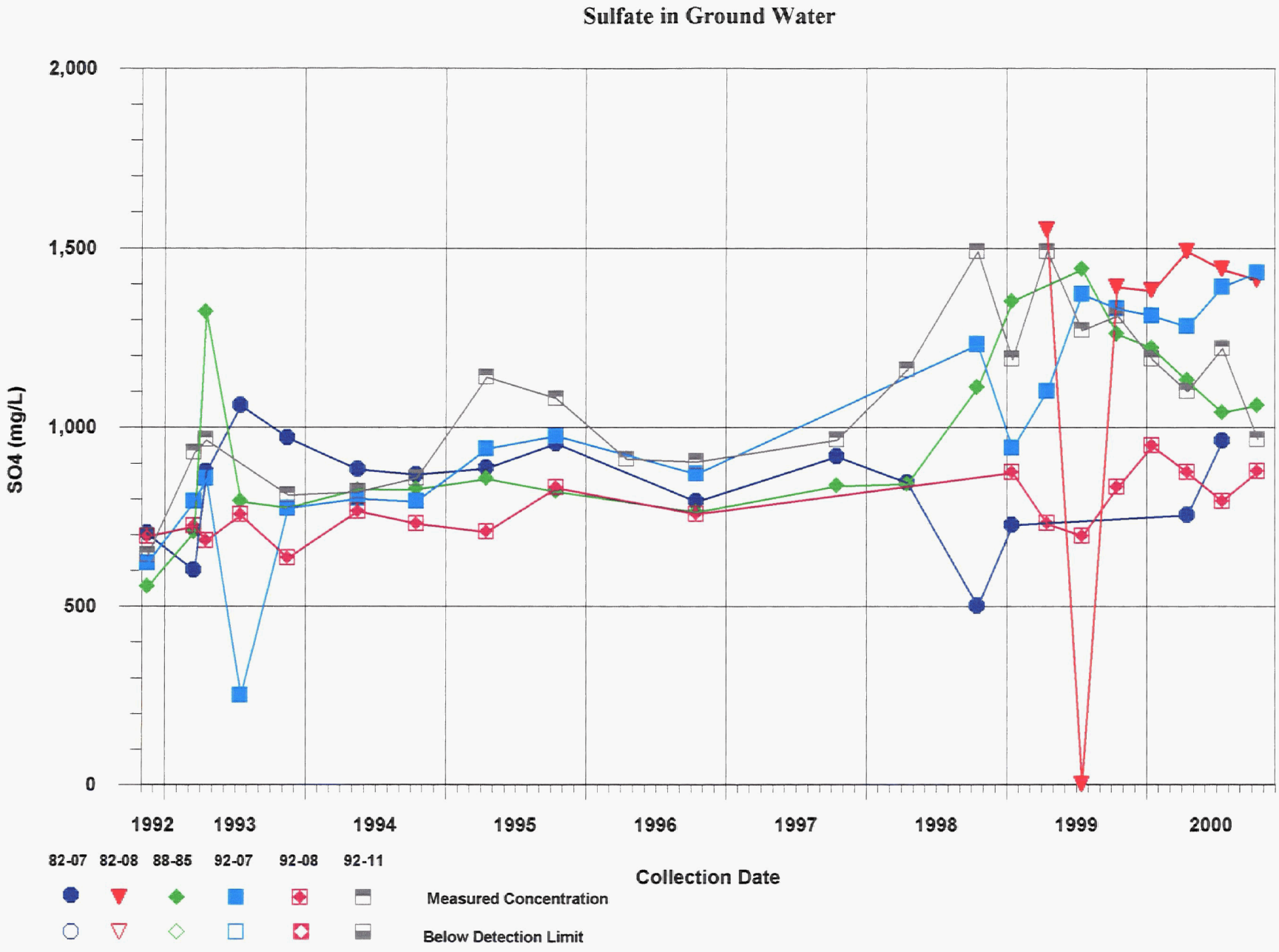

Sulfate in Ground Water
2,000
1,500
1,000
500
0
SO4 (mg/L)
1992
1993
1994
1995
1996
1997
1998
1999
2000
Collection Date
82-07
82-08
88-85
92-07
92-08
92-11
Measured Concentration
Below Detection Limit

Figure 3

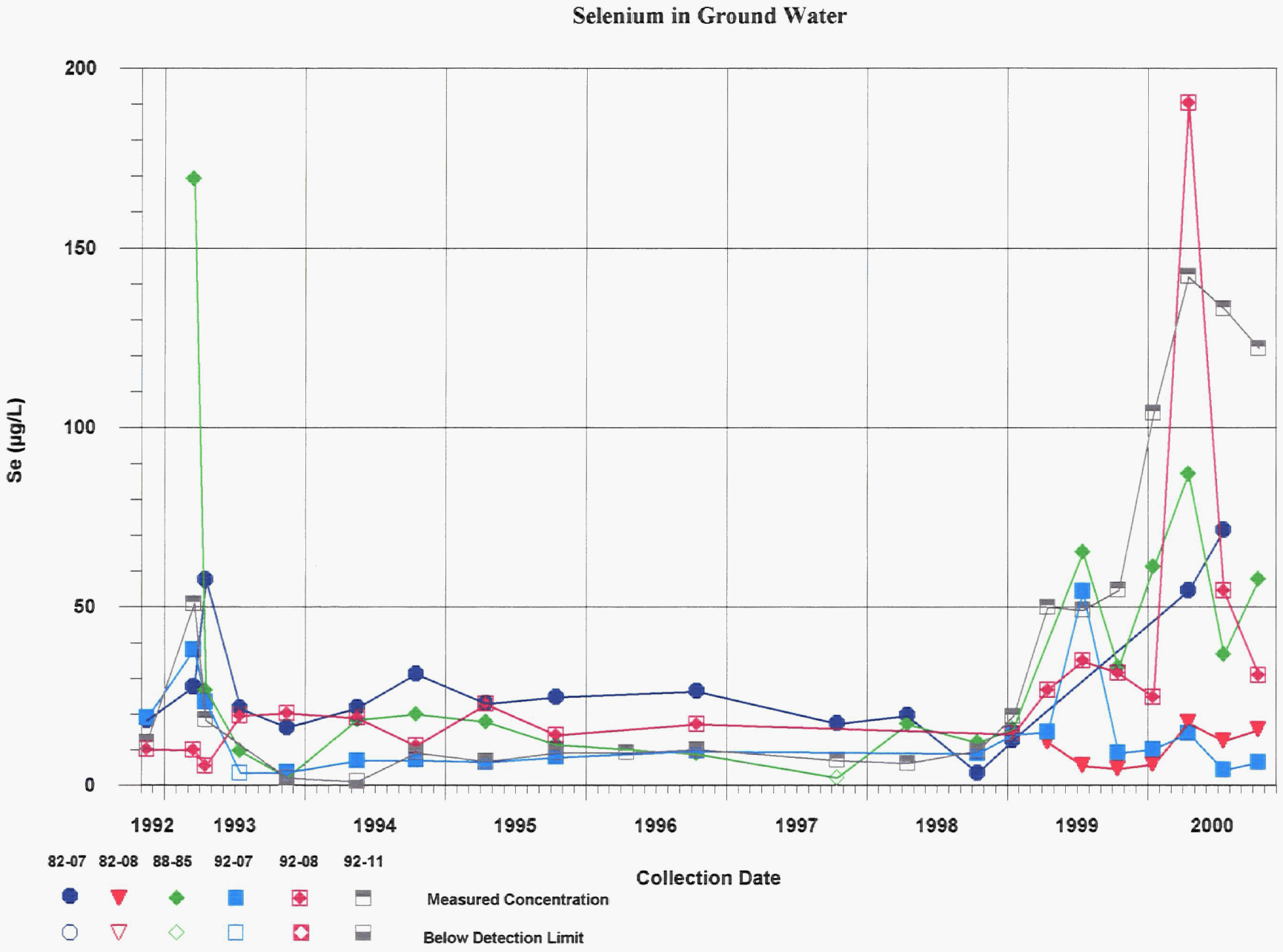

Selenium in Ground Water
Se (µg/L)
200
150
100
50
0
1992
1993
1994
1995
1996
1997
1998
1999
2000
Collection Date
82-07
82-08
88-85
92-07
92-08
92-11
Measured Concentration
Below Detection Limit

Figure 4

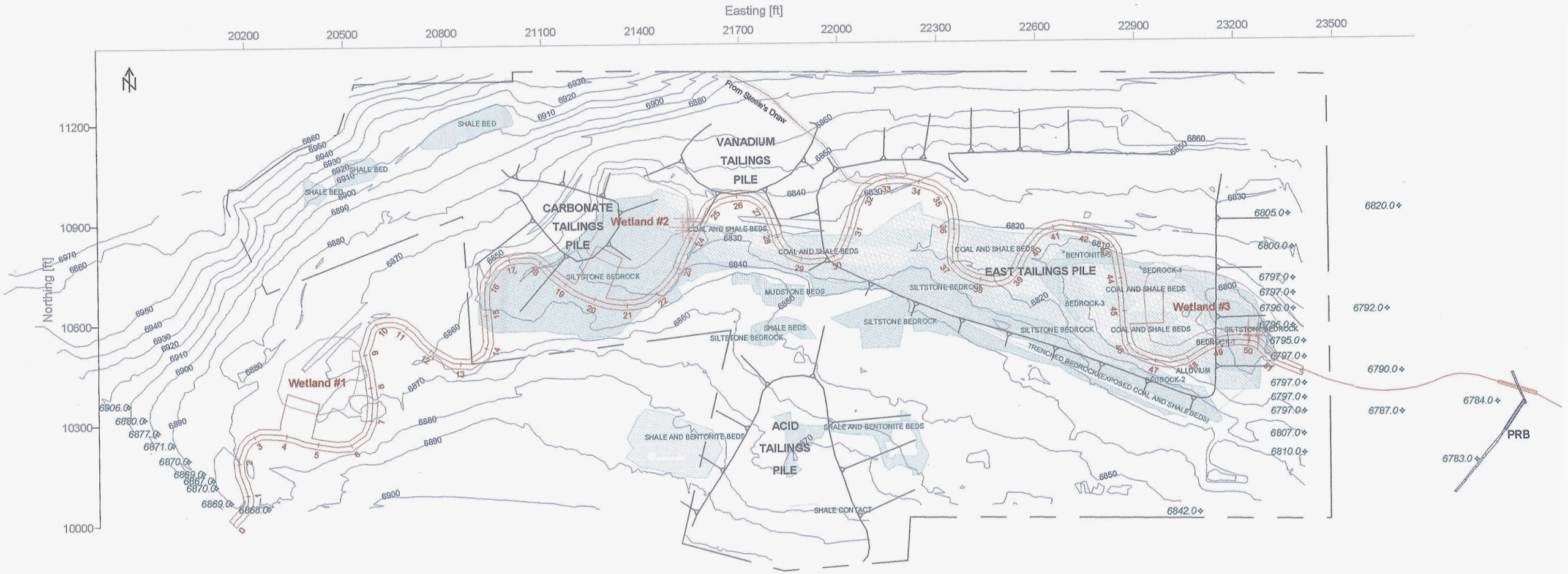

Easting [ft]
20200
20500
20800
21100
21400
21700
22000
22300
22600
22900
23200
23500
Northing [ft]
11200
10900
10600
10300
10000
From Steele's Draw
VANADIUM TAILINGS PILE
CARBONATE TAILINGS PILE
Wetland #2
EAST TAILINGS PILE
Wetland #3
Wetland #1
ACID TAILINGS PILE
SHALE BED
COAL AND SHALE BEDS
SILTSTONE BEDROCK
MUDSTONE BEDS
SHALE BEDS
SHALE AND BENTONITE BEDS
BENTONITES
BEDROCK-4
BEDROCK-3
BEDROCK-2
BEDROCK-1
TRENCHED BEDROCK(EXPOSED COAL AND SHALE BEDS)
ALLUVIUM
SHALE CONTACT
PRB
6820.0
6805.0
6800.0
6797.0
6792.0
6790.0
6787.0
6784.0
6783.0
6842.0
Bottom of Excavation
Original Pile Areas
Areas Excavated to Bedrock
Borehole location and bedrock elevation
Constructed Creek/Aquifer Corridor, Wetlands/Galleries

FIGURE 5

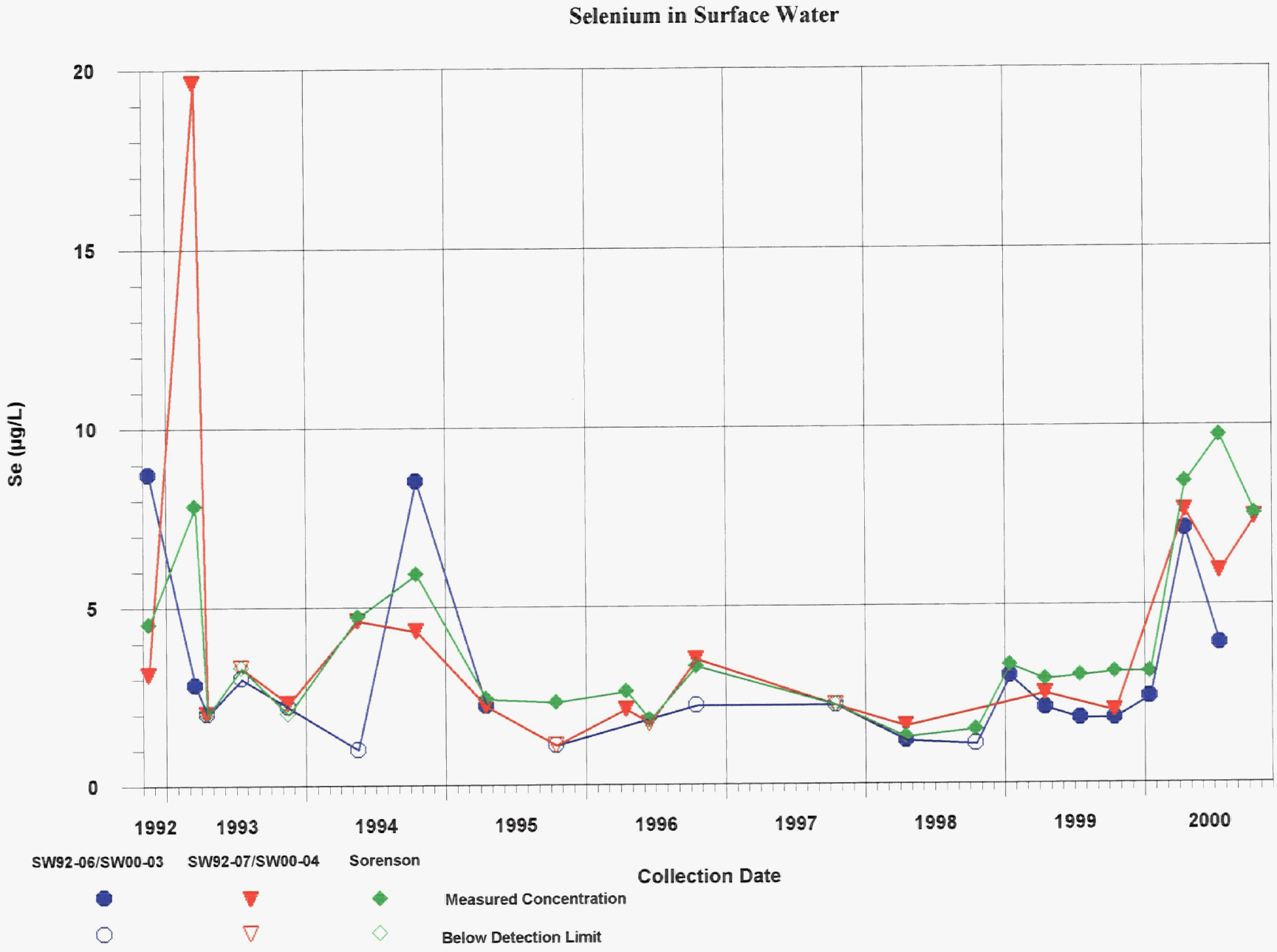

Selenium in Surface Water
Se (µg/L)
20
15
10
5
0
1992
1993
1994
1995
1996
1997
1998
1999
2000
Collection Date
SW92-06/SW00-03
SW92-07/SW00-04
Sorenson
Measured Concentration
Below Detection Limit

Figure 6

BRIGHAM YOUNG UNIVERSITY

Soil and Plant Analysis Laboratory
255 WIDB
Provo, UT 84602
378-2147

Date: 08-06-1998
Time: 14:27:11
Customer # 49
Telephone: 489-6937

Benson Agriculture and Food Institute
Name Mt. Nebo Scientific
Street 330 E. 400 S.
Springville Ut 84663
City State Zip

SOIL TEST REPORT AND RECOMMENDATIONS

Agronomy and Horticulture Department

Jensen Pit Borrow Area

Sample Identification	Crop to be Grown	pH	% Sand	% Silt	% Clay	Soil Texture	Cation Exchange meq/100g	% Organic Matter
OHM Crowley 3E-stock	Natives	6.27	40.00	35.44	24.56	Loam		2.17

Soil Test	Results	Very Low	Low	Ade-quate	High	Very High	Recommendations
Nitrate—Nitrogen ppm N	12.57		I				
Phosphorus ppm P	18.18			I			
Potassium ppm K	150.40			I			
Salinity-ECe mmhos/cm	0.35	I					no salinity problem
Zinc PPM Zn	0.44	I					apply 10 lbs of Zn/ac
Iron PPM Fe	18.62				I		no fertilizer needed
Manganese PPM Mn	15.04				I		no fertilizer needed
Copper PPM Cu	1.02				I		no fertilizer needed
Ammonium-Nitrogen ppm N	6.07	x					
% Gravel	6.34						

NOTES:

156.01

1/5

BRIGHAM YOUNG UNIVERSITY

Soil and Plant Analysis Laboratory
255 WIDB
Provo, UT 84602
378-2147

Date: 08-06-1998
Time: 14:27:49
Customer # 49
Telephone: 489-6937

Benson Agriculture and Food Institute

Name Mt. Nebo Scientific
Street 330 E. 400 S.
Springville Ut 84663
City State Zip

SOIL TEST REPORT AND RECOMMENDATIONS

Agronomy and Horticulture Department

Jensen Pit Borrow Area

Sample Identification	Crop to be Grown	pH	% Sand	% Silt	% Clay	Soil Texture	Cation Exchange meq/100g	% Organic Matter
OHM Crowley 3E-top	Natives	6.25	44.72	34.72	20.56	Loam		3.19

Soil Test	Results	Very Low	Low	Ade-quate	High	Very High	Recommendations
Nitrate—Nitrogen ppm N	4.69	X					
Phosphorus ppm P	20.29				X		
Potassium ppm K	192.00				X		
Salinity-ECe mmhos/cm	0.42	X					no salinity problem
Zinc PPM Zn	0.70	X					apply 10 lbs of Zn/ac
Iron PPM Fe	22.26				X		no fertilizer needed
Manganese PPM Mn	11.76				X		no fertilizer needed
Copper PPM Cu	0.78				X		no fertilizer needed
Ammonium-Nitrogen ppm N	11.38		x				
% Gravel	3.17						

NOTES:

156.01

2/5

BRIGHAM YOUNG UNIVERSITY

Soil and Plant Analysis Laboratory
255 WIDB
Provo, UT 84602
378-2147

Date: 08-06-1998
Time: 14:28:27
Customer # 49
Telephone: 489-6937

Benson Agriculture and Food Institute
Mt. Nebo Scientific
Name
330 E. 400 S.
Street
Springville Ut 84663
City State Zip

SOIL TEST REPORT AND RECOMMENDATIONS

Agronomy and Horticulture Department

Jensen Pit Borrow Area

Sample Identification	Crop to be Grown	pH	% Sand	% Silt	% Clay	Soil Texture	Cation Exchange meq/100g	% Organic Matter
OHM Crowley 3E-sub	Natives	6.05	44.72	32.72	22.56	Loam		2.10

Soil Test	Results	Very Low	Low	Ade-quate	High	Very High	Recommendations
Nitrate—Nitrogen ppm N	1.83	X					
Phosphorus ppm P	15.87			X			
Potassium ppm K	140.80			X			
Salinity-ECe mmhos/cm	0.29	X					no salinity problem
Zinc PPM Zn	0.36	X					apply 10 lbs of Zn/ac
Iron PPM Fe	18.14				X		no fertilizer needed
Manganese PPM Mn	11.96				X		no fertilizer needed
Copper PPM Cu	0.76				X		no fertilizer needed
Ammonium-Nitrogen ppm N	5.31	x					
% Gravel	4.68						

NOTES:

156.01

3/5

BRIGHAM YOUNG UNIVERSITY

Soil and Plant Analysis Laboratory
255 WIDB
Provo, UT 84602
378-2147

Date: 08-06-1998
Time: 14:29:02
Customer # 49
Telephone: 489-6937

Benson Agriculture and Food Institute
Mt. Nebo Scientific
Name
330 E. 400 S.
Street
Springville Ut 84663
City State Zip

SOIL TEST REPORT AND RECOMMENDATIONS

Agronomy and Horticulture Department

Jensen Pit Borrow Area

Sample Identification	Crop to be Grown	pH	% Sand	% Silt	% Clay	Soil Texture	Cation Exchange meq/100g	% Organic Matter
OHM Crowley 4W-top	Natives	6.16	44.00	33.44	22.56	Loam		3.94

Soil Test	Results	Very Low	Low	Ade-quate	High	Very High	Recommendations
Nitrate—Nitrogen ppm N	2.09	X					
Phosphorus ppm P	18.14			X			
Potassium ppm K	166.40			X			
Salinity-ECe mmhos/cm	0.42	X					no salinity problem
Zinc PPM Zn	0.68	X					apply 10 lbs of Zn/ac
Iron PPM Fe	27.40				X		no fertilizer needed
Manganese PPM Mn	11.32				X		no fertilizer needed
Copper PPM Cu	0.82				X		no fertilizer needed
Ammonium-Nitrogen ppm N	5.31	x					
% Gravel	4.58						

NOTES:

156.01

4/5

BRIGHAM YOUNG UNIVERSITY

Soil and Plant Analysis Laboratory
255 WIDB
Provo, UT 84602
378-2147

Date: 03-25-1999
Time: 11:03:11
Customer # 10
Telephone: 489-6927

Benson Agriculture and Food Institute

Agronomy and Horticulture Department

Name Mt Webs Scientific

Street 250 E. 1230 N.

Springville Ut 84663
City State Zip

SOIL TEST REPORT AND RECOMMENDATIONS

Jensen Pit Borrow Area

Sample Identification	Crop to be Grown	pH	% Sand	% Silt	% Clay	Soil Texture	Cation Exchange meq/100g	% Organic Matter
Crowley 3A 8-12	Natives	5.92	42.68	38.72	19.28	Loam		2.72

Soil Test	Results	Very Low	Low	Adequate	High	Very High	Recommendations
Nitrate—Nitrogen ppm N	3.27	X					
Phosphorus ppm P	18.33			X			
Potassium ppm K	246.00				X		
Salinity-ECe mmhos/cm	0.41	X					no salinity problem
Zinc PPM Zn	0.47	X					apply 10 lbs of Zn/ac
Iron PPM Fe	18.41				X		no fertilizer needed
Manganese PPM Mn	8.85				X		no fertilizer needed
Copper PPM Cu	0.29			X			no fertilizer needed
ppm NH_4-N	13.66			x			
% gravel	4.82						

NOTES:

156.03

8/13

BRIGHAM YOUNG UNIVERSITY

Soil and Plant Analysis Laboratory
255 WIDB
Provo, UT 84602
378-2167

Date: 03-25-1999
Time: 10:06:22
Customer # 10
Telephone: 489-6937

Benson Agriculture and Food Institute

Agronomy and Horticulture Department

Name Mt Nebo Scientific
Street 290 E. 1230 N.
Springville Ut 84663
City State Zip

SOIL TEST REPORT AND RECOMMENDATIONS

Jensen Pit Borrow Area

Sample Identification	Crop to be Grown	pH	% Sand	% Silt	% Clay	Soil Texture	Cation Exchange meq/100g	% Organic Matter
Crowley SL 0-12	Natives	6.16	47.28	35.44	17.28	Loam		2.35

Soil Test	Results	Very Low	Low	Adequate	High	Very High	Recommendations
Nitrate—Nitrogen ppm N	3.68	X					
Phosphorus ppm P	21.28				X		
Potassium ppm K	168.88					X	
Salinity-ECe mmhos/cm	0.56	X					no salinity problem
Zinc ~~ppm Zn~~	0.40	X					apply ~~1~~ lbs of Zn/ac
Iron ~~ppm Fe~~	9.31			X			no fertilizer needed
Manganese ~~ppm Mn~~	6.39				X		no fertilizer needed
Copper ~~ppm Cu~~	0.27			X			no fertilizer needed
ppm NH_4-N	3.79	X					
% gravel	3.74						

NOTES:

156.03

13/13

BRIGHAM YOUNG UNIVERSITY

Soil and Plant Analysis Laboratory
255 WIDB
Provo, UT 84602
378-2147

Date: 03-25-1999
Time: 18:07:16
Customer # 10
Telephone: 489-6937

Benson Agriculture and Food Institute
Mt Nebo Scientific

Name _____
290 N. 1230 W.
Street _____
Springville | Ut | 84663
City | State | Zip

SOIL TEST REPORT AND RECOMMENDATIONS

Agronomy and Horticulture Department

Jensen Pit Borrow Area

Sample Identification	Crop to be Grown	pH	% Sand	% Silt	% Clay	Soil Texture	Cation Exchange meq/100g	% Organic Matter
Crowley 58 13-72	Natives	6.43	41.28	35.44	23.28	Loam		1.69

Soil Test	Results	Very Low	Low	Ade-quate	High	Very High	Recommendations
Nitrate—Nitrogen ppm N	1.08	X					
Phosphorus ppm P	22.41				X		
Potassium ppm K	169.66					X	
Salinity-ECe mmhos/cm	0.54	X					no salinity problem
Zinc PPM Zn	0.29	X					apply 26 lbs of Zn/ac
Iron PPM Fe	9.69			X			no fertilizer needed
Manganese PPM Mn	8.97				X		no fertilizer needed
Copper PPM Cu	0.28			X			no fertilizer needed
ppm NH_4-N	3.79						
% gravel	7.16						

NOTES:

156.03

13/13

BRIGHAM YOUNG UNIVERSITY

Soil and Plant Analysis Laboratory
255 WIDB
Provo, UT 84602
378-2147

Date: 03-25-1999
Time: 17:59:13
Customer # 10
Telephone: 489-6937

Benson Agriculture and Food Institute
Mt Nebo Scientific

Name _____
Street 290 E. 1230 N.
Springville Ut 84663
City State Zip

SOIL TEST REPORT AND RECOMMENDATIONS

Agronomy and Horticulture Department

MP-00179 Phase III
In-Place Soil (Backfilled)

Sample Identification	Crop to be Grown	pH	% Sand	% Silt	% Clay	Soil Texture	Cation Exchange meq/100g	% Organic Matter
OLM Riparian Comp	Natives	6.47	40.00	38.72	21.28	Loam		2.13

In-place Sample Results on MP-00179, Phase III (eastern portion).
H. Berry
3/26/99

Soil Test	Results	Very Low	Low	Adequate	High	Very High	Recommendations
Nitrate—Nitrogen ppm N	5.08	X					
Phosphorus ppm P	81.75			X			
Potassium ppm K	255.20					X	
Salinity-ECe mmhos/cm	1.16		X				no salinity problem
Zinc PPM Zn	0.33	X					apply 10 lbs of Zn/ac
Iron PPM Fe	10.90				X		no fertilizer needed
Manganese PPM Mn	5.70				X		No fertilizer needed
Copper PPM Cu	0.24			X			no fertilizer needed
ppm NH_4-N	96.37					x	
% gravel	18.31						

NOTES:

156.02

2/2

04

PRE-EXISTING CONDITIONS at Sommerville 5
PRE-(REMEDIAL)

1991
1993

Marilyn Kastens
RUST GEOTECH, INC.
P.O. Box 14000/2597 B 3/4 Road
Grand Junction, CO 81502-5504

A = A Horizon of Soil
B = B Horizon of Soil

Colorado State University
Soil, Water and Plant Testing Laboratory
Room 6, Vocational Education Building
Fort Collins, CO 80523
303-491-5061

DATE RECEIVED: 08/20/93
DATE: 09/29/93
BILLING:

RESEARCH SOIL ANALYSIS

Lab #	Sample ID #	mg/kg AB-DTPA extractable P	K	NO_3-N	Zn	Fe	Mn	Cu
R874	Past F-A	14.0	365	7.0	4.1	17.7	9.9	19.0
875	Past F-B	4.7	276	4.0	1.6	23.2	4.9	4.7
876	Past E-A	20.5	437	8.0	3.1	19.9	9.0	11.3
877	Past E-B	12.7	330	2.0	1.5	13.9	5.3	4.5
878	Past D-A	21.8	543	19.0	4.3	19.2	10.7	8.6
879	Past D-B	6.0	262	4.0	2.2	23.2	5.8	4.5
880	Past C-A	19.3	438	2.0	2.5	13.7	15.2	5.2
881	Past C-B	8.1	311	1.0	0.5	9.0	6.9	1.8
882	Past B-A	25.3	338	5.0	5.7	56.7	25.2	17.1
883	Past B-B	10.3	307	3.0	1.7	19.5	10.9	4.9
884	Past 947-A	6.4	236	7.0	1.1	11.4	8.1	3.6
885	Past 947-B	2.5	211	4.0	0.6	11.1	5.6	3.5
886	Nat N-A	9.9	422	3.0	1.2	7.3	5.8	7.7
887	179 Shrub A	18.2	483	5.0	1.8	17.4	9.0	5.2
888	179 Shrub B	3.1	314	2.0	0.9	15.2	5.6	3.3
889	179 Wet - A	4.4	233	9.0	9.4	159.0	7.6	14.0
890	179 Wet - B	1.4	173	7.0	1.1	67.8	5.8	5.2
891	Bottom A	36.1	433	23.0	6.3	37.3	10.5	35.5
892	Bottom B	10.7	323	3.0	3.0	44.7	5.6	14.4
893	Nat S-A	50.6	940	8.0	4.9	21.8	18.8	17.5
894	Nat S-B	27.6	743	4.0	2.8	30.1	8.7	7.8
895	MS 144 - Gar	16.7	233	13.0	2.5	14.1	11.5	2.3
896	MS 144 - Sod	11.1	478	3.0	13.7	21.4	17.2	8.8
897	MS 241	67.0	351	3.0	5.1	37.5	12.3	5.3
898	MS 242	6.7	297	3.0	2.3	29.2	12.0	6.5

MP-179

Marilyn Kastens
GEOTECH, INC.
P. O. Box 14000
Grand Junction CO 81502–5504

DATE RECEIVED: 12/18/91

CSU SOIL TESTING LABORATORY
Room 6, Vocational Education Building
Fort Collins, CO 80523
303–491–5061
DATE: 01/24/92
BILLING:

RESEARCH SOIL ANALYSIS

Lab #	Sample ID #		Paste pH	mmhos/cm Paste E. C.	mg/kg 2m KCl NO_3–N	mg/kg 2m KCl NH_4–N	mg/kg 2m KCl NO_2–N	mg/kg AB–DTPA P	mg/kg In Ammonium Acetate Extract K	% O. M.	meq/100 g CEC
R5518	NAN 863	mP-179-A1	7.6	0.8	15.8	12.6	2.6	6.4	663	*11.7	27.4
5519	NAN 864	mP-179-B1	7.2	2.3	26.0	4.2	2.1	0.5	324	3.4	24.6
5520	NAN 867	mP-179-A2	7.6	2.9	130.0	6.4	2.0	115.0	2302	*15.0	33.1
5521	NAN 869	mP-179-B2	7.4	2.0	97.0	15.8	1.5	9.9	950	4.3	25.5
5522	NAN 308		7.8	1.6	106.0	27.4	3.0	18.2	1142	*21.9	31.3
5523	NAN 309		7.8	1.5	7.8	1.9	1.5	0.5	175	1.7	19.9
5524	NAN 310		7.2	0.5	6.1	2.9	1.0	3.4	337	4.7	23.0
5525	NAN 311		7.4	0.6	2.1	4.8	1.0	1.4	191	1.5	19.0
5526	NAN 857		7.6	0.6	8.6	6.0	1.7	0.8	183	3.6	21.6
5521	NAN 869	Duplicate	7.4	2.0	100.0	15.5	1.4	11.1	896	4.4	25.5
5521	NAN 869	Spike					3.2	13.5	1288		
5523	NAN 309				11.5	11.1					
5521	% Spike Recovery				111.7	95.4	90.0	120.0	98		
5527	NAN 858		7.6	0.5	0.9	3.7	1.1	<0.1	150	1.3	20.6
5528	NAN 859		7.8	0.6	6.6	8.0	2.2	1.7	218	2.9	20.6
5529	NAN 860		7.7	0.7	3.7	9.8	1.7	<0.1	123	2.0	20.2
5530	NAN 861		7.7	0.5	6.1	6.5	1.5	2.8	204	3.3	20.0
5531	NAN 862		7.7	0.6	5.1	5.7	1.2	0.3	124	1.3	17.3
5532	NAN 312		7.8	0.9	16.9	7.5	2.2	11.9	540	*12.6	31.3
5533	NAN 313		7.8	1.7	10.8	4.2	1.2	0.3	182	1.8	22.2
5534	NAN 314		7.5	0.7	21.1	12.7	1.5	15.3	452	5.8	22.8

*Weight Loss on Ignition